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ECONOMIC ANALYSIS OF TRADERS' RESPONSE TO
CEREALS MARKET REFORMS IN MALI

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ECONOMIC ANALYSIS OF TRADERS' RESPONSE TO CEREALS MARKET REFORMS IN MALI

By

Niama Nango Dembélé

A DISSERTATION

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ABSTRACT

ECONOMIC ANALYSIS OF TRADERS' RESPONSE
TO CEREALS REFORMS IN MALI

By

Niama Nango Dembélé

Following the cereals market reforms of 1981, depressed producer prices that result from excess production over domestic consumption requirements have became a major concern in Mali. The problem is inadequate investment by traders in storage and cereals exports to expand market demand. The objective of the study was to analyze the determinants of traders' investment in storage and cereals exports, and to investigate how traders' choice of coordination mechanisms affects their investment behavior. The study used and extended the transaction-cost framework to analyze supply side factors that constrain traders' choice of coordination mechanisms.

Cluster analysis, regression techniques, and means comparison tests were performed to analyze the structure of the marketing system, the factors that affect traders' choice of alternative coordination mechanisms, and the relationship between alternative coordination mechanisms and investment in storage and trucking capacity, stock holding, and cereals exports. The different analyses used data collected in 1990 and updated in 1993 through direct interview of 55 traders in three different cities.

The study found that the marketing system comprised two different substructures, referred to as the core composed of small scale traders and the periphery composed of large scale traders.

The use of contracts arrangements as a coordination mechanism was found to be a function of trading experience, scale of operations, managerial ability, specialization in grain trade, and the spatial distribution of cereals transactions. However, the study found that as the scale of operations expands, traders moved away from informal contracts with clients and relied more on spot-market transactions.

Average investment in storage and trucking capacity was higher and more stable for the periphery than for the core, and for traders who use contracts than for traders who use spot markets. Investment in stock holding was found to be determined by realized export demand, expected demand in the deficit zones, and availability of rented storage capacity. Ownership of trucks and contractual arrangements substituted for stock holding. Investment in export operations were found to be a function of scale of operations, and access to formal credit played a minor role in traders' investment behavior in marketing infrastructure, stock holding, and export operations.

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Chapter I

1. Introduction

1.1 Background Statement

With 80% of its population of 8 million dependent on agriculture for much of their livelihood, Mali had a Gross National Product (GNP) per capita of $270 in 1989. During that year, agriculture contributed 50% to Gross National Product and provided 90% of the country's export earnings (World Bank, 1991, 204-208). The major food crops grown are millet, sorghum, corn and rice. The agricultural exports are mainly cotton and livestock products.

Cereals account for 80% of the total calorie intake in Mali, while millet, sorghum and corn provide 85% of the cereal calories (Staatz et al. 1989, 704). Rural consumers produce most of their cereals needs, and as a consequence, only about 15% of total cereals production reaches the market. Urban consumers devote about 51% of their total expenditures to food, and cereals make up 48% of household food expenditures (Badiane et al. 1992, 13). Therefore, cereals prices strongly influence urban consumers' real incomes.

1.1.1 Past Marketing Policies

In the 1960's, the country was more than self-sufficient in food production, with net cereals exports varying between 9,000 and 37,000 tons per year (Dioné, 1989, 16). Historically, increases in food production have come mainly from cropland expansion. Between 1970 and 1990, yields of millet and sorghum stood at the average level of 0.76 and 0.86 metric ton per ha respectively. During the same period, production of millet and sorghum grew at an annual rate of 3%, with yield increases accounting for 1.2% of the growth rate and area expansion contributing for 1.8%. Corn production grew at 4.7% per year, with yield increases accounting for 1.9% and

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area expansion for 2.8% (Badiane et al. 1992, 24).

Many authors attribute the lack of productivity gains in cereal production in the 1970's and the 1980's to government policies. In 1960, after independence, the government opted for a socialist development strategy. This strategy led to the creation of state farms, producer cooperatives, and a plethora of state trading organizations responsible for the marketing of agricultural and industrial products. In 1964, the Office des Produits Agricoles du Mali (OPAM) was created and given the official monopoly over grain trade.

Until 1973, the stated objectives of government agricultural policies were to increase rural incomes, to provide cheap cereals to urban consumers, and to extract a surplus from agriculture to finance the industrialization process. However, with little growth in productivity in the cereal sector, it became difficult for the government to achieve simultaneously these three conflicting objectives. In practice, the government opted for the objectives of cheap cereal supplies to urban consumers and extraction of a surplus from agriculture. Policy makers assumed that a potential surplus existed in agriculture that could be transferred to the industrial sector without any consequences for food production. To achieve these objectives, the government used the following policy instruments: fixed prices, taxation, state monopolies over crop marketing, and agricultural research, along with extension and credit for export crops.

Between 1960 and 1981, the major food crop prices were fixed by the government both panseasonally and panterritorially. Millet and sorghum had the same official price. Only corn and rice were differentiated from the other cereals. Both the official producer and consumer price varied from year to year based on government decisions, regardless of changing demand and supplies conditions. From 1970 to 1979, nominal official prices for millet and sorghum went from 10 CFAF/kg to 25 CFAF/kg, while nominal official

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consumer prices went from 18 CFAF/kg to 39 CFAF/kg (Sijm, 1992, 80). Compared to other Sahelian countries, official producer prices in Mali were depressed during the 1970's. Indeed, while millet and sorghum producers in Burkina Faso received 57 CFA/kg and those in Senegal received 37 CFAF/kg from their governments, Malian producers received only 25 CFAF/kg in 1979 (Ibid).

Although the official producers price was low compared to neighboring countries, there existed in most years a widespread parallel market for cereals. As a result, many producers did not face official prices. Thus, for most producers, prices did vary over time and space. What existed between 1961 and 1981 was a dual marketing system where legal constraints to private grain trade may have reduced the producers' price in the parallel market because traders had to charge a high risk premium on cereals prices (Dioné, 1989).

The low official prices were intended to extract the maximum surplus from agriculture. For instance, the average rate of taxation of cotton producers was 37% between 1974 and 1979 against 41% for coarse grain producers (Lecaillon, 1986). The calculated average taxation rates represent only the difference between what the farmers would have received for their production at market prices and what they received from the government, by taking into account government subsidies and investment in the agricultural sector. The lower taxation rate of export crops compared to food crops reflected the government's need to encourage the expansion of cash crops to earn foreign exchange for industrialization.

In order to force farmers to provide cities with an adequate food supply and produce export crops, the government maintained the "head tax" instituted by France during colonization. By fixing both the producer price and the rate of the "head tax", the government could secure food supplies for the cities. For example, by increasing the "head tax" rate and lowering producer price, the government could collect enough production from

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farmers. Indeed, during the crop year of 1985/86, the "head tax" represented between 12% and 23% of the market value of cereal production of farm households in the CMDT and OHV zones (Dioné, 1989, 212). During the same crop year, the "head tax" constituted the number one motive for selling cereals for 50 to 90% of farm households who sold cereals (Dioné, 1989, 214).

To make the price and tax policies more effective, the marketing of major crops was officially under state control. OPAM, the marketing board with an official monopoly over coarse grains marketing, secured its grain collection through the newly created farmers cooperatives and the diverse rural development operations (ODRs). Moreover, OPAM had the legal monopoly over cereals exports and food imports. However, OPAM had no power to set official prices. That authority belonged to a national commission. The national commission determined the marketing margins for OPAM and the diverse ODRs. To secure enough grain supplies for OPAM, as parallel markets developed due to low official policies, the government set delivery quotas for farmers based on the potential of their agricultural regions. To prevent private shipments of grain within the country, an economic police force and roadblocks were established.

To increase export revenues, production of export crops was encouraged on the best land through stable marketing and credit services, extension services and the development of technological packages. Rural development operations (ODRs) were set up with the objectives of giving extension and credit services to farmers producing export crops and rice (an import substitute). From 1960 to 1973, agricultural research and extension efforts focused on the development and diffusion of new technologies for these crops. These efforts were directed at animal traction equipment and the optimum level of fertilizer use for cotton (Dioné, 1989, 225-227). It was only after the drought of 1973 that researchers

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started to develop drought resistant varieties of millet.

The generation and diffusion of new technologies through a dense network of extension services along with an adequate marketing and credit system allowed export-crops and rice- growing farmers to get access to farm inputs such as fertilizer and equipment. For instance, in the southern part of the country where most of the cotton is produced, more than 75% of the farmers possess some animal traction equipment compared to fewer than 50% of the farmers who grow only coarse grains (Dioné,1989, 62). Furthermore, cotton and rice use more than 2/3 of total purchased inputs (Ibid). These investments have paid off specifically for cotton production, which grew at 8% per year between 1970 and 1990 (Badiane et al. 1992, 24). In contrast to cereals, cotton yields grew by 5% per year while area expanded by 3% per year (Ibid).

With respect to the objectives of supplying cheap cereals to urban centers and of extracting a surplus from agriculture, the government policies have been highly successful. Between 1969 and 1982, the pricing and marketing policies along with the "head tax" led to a cumulative net surplus transfer (computed by adding all the taxes, either direct or indirect, paid by the rural population less all the subsidies and services received from the government) of 51.6 billion CFAF, or $172 million from agriculture to the other sectors of the economy (Lecaillon, 1986). However, this net surplus dropped during the droughts years of the 1970's. It rose during the 1980's and reached levels well above those of the 1970's.

The success of the agricultural surplus extraction and the concentration of government investment on export crops and rice has undermined the capacity of the cereals subsector to tap the full potential of yield increases, estimated at 2 metric tons per ha for millet with fertilizer and 5 metric tons per ha for corn (Badiane et al. 1992, 42). Indeed, over the years, the cereals subsector has undergone modest technological change, and

purchased input consumption is marginal compared to that in cotton and rice. Given the existing technology and price levels, it did not pay to apply fertilizer to coarse grains, especially millet and sorghum. Thus, the yield potential estimated by Badiane is an agronomic potential, but not the profit-maximizing level of yields.

Part of the problem of low capitalization of coarse grains production was that the surplus extracted from agriculture wasn't productively reinvested in the country. A lot of it left the country and some of it was spent on non-productive projects and loss-making state enterprises. As a consequence, the surplus didn't generate much external demand from the non-agricultural sectors that could have served as an engine of growth for agriculture.

The lack of adequate capital formation in grain production received increased attention following the 1968-73 severe drought. During the drought, cereals production was wiped out and the whole economy nearly collapsed. Although the international community responded promptly by shipping large amounts of food aid, the lack of adequate transportation infrastructure and the rigidity of official food distribution systems prevented much of the food aid from reaching the rural population in producing zones. Indeed, government food distribution efforts were concentrated in urban areas and in the Northeast of the country. Only the private sector responded vigorously by importing important quantities of grain and redirecting some amount of the food aid to rural areas in producing zones.

Policy makers were surprised by the ability and the effectiveness of the private sector to secure enough food supply to meet the effective rural demand. The effective rural demand was the result of a massive disinvestment of the rural economy, as farmers sold their assets to survive. Those farmers who could not generate enough purchasing power went into debt and suffered severe food shortages. Since 1973, the need to avoid a

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repetition of the catastrophe of the 1968-73 drought and to rebuild the productive capacity of farmers has influenced the evolution of cereals policy in Mali.

1.1.2 Need for cereals market reforms

With the reaching of the limits of the frontier, increases in food production through land expansion were no longer possible to meet the food needs of a growing population. With few gains in productivity in cereals production over the years, the country turned from a position of net cereals exporter into a position of net importer. Since 1973, annual food imports have varied between 20,000 and 191,000 tons depending on the year (Sijm, 1992, 5). With an increasing dependency on external food sources, despite a huge potential for cereals production, and the increasing cumulative deficit of OPAM, which reached $80 million in 1976-77, the government was forced to change both the objectives and the instruments of its food policies under the pressure of donors in 1980.

The objectives of the new policies are to make Mali self-sufficient in cereal production through major reforms in the grain economy[1]. The main reform thus far has been the Cereals Market Restructuring Project, known as PRMC, which has been carried out with the help of a group of donors beginning in 1981. During the early years of the PRMC, when the country was still facing severe food deficits, the objectives of the PRMC were to increase the role of the private sector in the grain trade, to reduce marketing costs through increased competition and a better management of OPAM, and to transfer resources to farmers to enable them to invest in productivity-increasing technologies. Food aid sales receipts were to be used to stabilize and increase market prices for cereals. To achieve these objectives, the PRMC removed the legal constraints to private grain trade, set producer and consumer prices, and assigned a market price stabilization role to OPAM to

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[1]   See Steffen (1992, Annex 2.1) for a good description of this process of reform.

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These policy instruments worked until 1986, when the country started to produce important cereals surpluses. Indeed, in 1986, the ability of OPAM to stabilize market prices was called into question when OPAM lacked the necessary resources to support the official producer price despite the purchase of 70,000 tons. With unsold accumulated stocks in 1986, OPAM was unable to intervene in the market in 1987 to support producer prices (Staatz et al. 1989). Since then, the role of OPAM has been reduced to the distribution of food aid, the management of a national security stock, and the collection and diffusion of market information. At the same time, the determination of producer and consumer prices was left to market forces, and legal constraints to private cereals exports were removed. The adjustment in cereals marketing policies in 1987 was based on the assumption that competition would increase as traders responded quickly to the new opportunities. Policy-makers believed that increased competition would compress marketing margins, and thus, would increase producer prices and lower consumer prices.

1.2 Problem Statement and Justification of the Study

Following the cereals market reforms of 1981 and 1987, the nominal producer price of millet and sorghum has averaged 47 CFAF/kg between 1987/88 and 1989/90, well below the estimated production cost of 56 CFAF/kg with animal traction in the good harvest year of 1985/86 (Stryker et al., 1987). At the same time, the real producer price fell by 8% below its level of 1980/81 (computed from Sijm, 1992,). The downward pressure on the producer prices results from surplus production with the return of normal rainfall pattern in the Sahel since 1986 that confronts a limited effective domestic market demand. Surplus production is defined here as excess production over domestic consumption requirements. This downward pressure on prices has resulted in negative returns to farm family labor, the

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main resource used in cereals production (Stryker et al., 1987; Barry et al., 1993). These negative returns to farm labor have become the main policy concern in Mali.

The fundamental problem that must be addressed in the view of Malian policy makers, is the lack of adequate traders' investment in market demand-expansion operations, such as cereals exports, storage, and cereals transformation for both human and non-human consumption to dispose of surplus production at prices that provide positive returns to farmers' labor. In response to this problem, the government and the PRMC set up in 1987 diverse credit programs to induce traders to invest in storage. Similarly, the government and the PRMC subsidized traders' cereals exports to encourage the integration of the domestic market into the larger regional cereals market of West Africa. However, these programs have failed to induce traders to invest in storage and cereals exports at levels expected by policy-makers (Mehta, 1989, Steffen, 1992). For example, average traders' stocks holding, under the storage credit programs, represented only 1.54% of estimated surplus production between 1987 and 1992, while official subsidized exports represented only 3.3% of the same surplus (Guindo, 1993).

The reasons why traders have not responded to these programs by investing in stock holding and specifically in cereals exports is not well known. However, there is a need for increased cereals exports to integrate the domestic market into the wider regional market of West Africa to reduce price variability and to provide a favorable price environment to farmers. According to Fafchamps (1992), gains in food crop productivity have limited potential for agricultural development if local markets are not better integrated into wider regional, national, and international markets to reduce price instability and to increase the price elasticity of demand.

Empirical evidence suggests that a stable and favorable price milieu is essential for

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farmers to maintain existing resources in cereals production. Moreover a stable and favorable price environment is essential for farmers to adopt cost-effective technologies that reduce unit production cost and raise labor productivity in the long run (Lele and Mellor, 1988). Thus, the main policy questions that must be addressed are: Does the existing private marketing system have the resources and the incentives to create such favorable price environment through storage and the integration of the domestic market into the wider regional market of West Africa? What are the organizational requirements for coping with the risk attached to such increased investment in storage and cereals exports to integrate the domestic market into the regional market of West Africa?

The integration of the domestic market into the wider regional market of West Africa through exports has the potential to increase the demand for storage, and the elasticity of market demand facing Malian farmers. Furthermore, the wider regional market of West Africa has the potential to reduce the variance of domestic prices, as national supply variations will have less impact on domestic prices, and thus, to increase farmers' supply response to price incentives (Fafchamps, 1992). Therefore, information on the determinants of traders' choice of alternative coordination mechanisms and their relationship to investment in storage and cereals exports is highly needed to assist the government in the design of more effective programs. This study contributes to this understanding.

1.2.1 Study Objectives

The general objective of this study is to analyze the main determinants of traders' investment in storage and cereals exports. The specific objectives of the study are to:

(1) analyze the evolution of traders' investment in storage and trucking capacity over time

(2) analyze the determinants of traders' choice of alternative coordination mechanisms.

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A coordination mechanism is defined here as the set of operating practices and institutions such as spot markets and contracts that synchronize adjacent stages of the cereals subsector (Marion, 1985).

(3) examine the relationship between choice of coordination mechanisms and investment in storage and cereals exports.

1.2.2 General Approach and Research Hypotheses

This study endogenizes the choice of observed coordination mechanisms considered as exogenous in past marketing studies in developing countries and asks the following research questions:

(1) What determines traders' choice of alternative coordination methods?

(2) How do traders' choice of alternative coordination mechanisms influence their investment behavior?

To address these questions, this study extends the transaction-cost theory in the tradition of Williamson to derive the following hypotheses to be fully developed and tested in subsequent chapters:

(1) Adoption of contractual arrangements over spot-market transactions is positively related to scale of operations, managerial ability, experience, degree of specialization in cereals trade, and the spatial location of transactions.

(2) Average investment in storage and cereals exports is determined by the ability to bear risk and to minimize the transaction costs associated with dealing in foreign markets and the capacity to choose contractual arrangements to manage risk.

The theory of transaction-cost in the tradition of Williamson states that alternative coordination mechanisms are adopted to minimize transaction costs. Transaction costs are defined here as costs associated with information search and contractual arrangements.

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These costs are functions of the different attributes of transactions. The theory identifies uncertainty, specificity of the investment that supports transactions, and frequency of the transactions as the main attributes of transactions that influence the level of transaction costs.

Transaction-cost theory postulates that asset specificity (proxied by the degree of specialization in cereals trade in this study) and the spatial location of cereals transactions may favor contracts over spot markets in the coordination process of cereals flow across stages. However, adoption of contracts as coordination mechanisms depends on traders' scale of operation, managerial ability, and experience in the cereals trade. According to Collins and Holton (1964), traditional traders may fail to adopt the set of operating practices and institutions to expand market opportunities in response to increased production because of inadequate scale and limited managerial ability. Indeed, Williamson (1985) has argued that the fixed costs of establishing contractual arrangements will have to be spread over a large scale of transactions or frequent transactions over time.

In addition to the scale of operations, Harrison et al. (1974) state that the inability of traders in developing countries to adopt improved standard operating procedure is related to their low managerial skills. For example, the increase in the scale of operations needed to lower the establishment cost of contracts requires adequate managerial ability to plan the increased supplies, sales, and cash flow needs demanded by higher scale. However, experience in cereals trading can substitute for the required scale of operations by lowering the search cost for reliable partners. Indeed, experienced traders have more contacts than new comers, and a reputation of reliability built over time constitutes an important asset that attracts potential partners.

The second hypothesis implies that before traders can invest in stock holding and

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cereals export operations, they must have an adequate scale of operations and adequate coordination mechanisms to bear and to manage the risk attached to such operations. Thus, credit programs for storage and cereals exports will not become effective before traders have set up the necessary coordination mechanisms that allow them to pool, share, and minimize the risk of such programs. According to Bromley and Chavas (1989), the "existence of implicit or explicit contracts among economic agents" is a precondition to expand exchange opportunities beyond the narrow circle of acquaintances.

With uncertain markets, supplies of goods and services cannot be defined without first specifying the random structure of demand (Carlton, 1978). Indeed, traders are concerned not only with the expected returns to storage and exports, but also with unsold stocks. Therefore, we hypothesize that traders will seek to stabilize the demand they face through the choice of contractual arrangements before committing important resources to storage and export operations. For example, a trader will not accumulate cereals stocks for shipment outside the country without first acquiring sales contracts with foreign clients. However, the ability of traders to deliver cereals on time in foreign markets depends on their ability to mobilize the contracted quantities on short notice in the domestic market. This requires reliable trading relationships with suppliers from producing zones unless a trader has the adequate scale to bear the risk attached to stocks accumulation in anticipation of export opportunities. Thus, contractual relationships with domestic suppliers can substitute for stock accumulation in anticipation of cereals exports.

The main coordination mechanisms retained for this study are spot-market transactions and informal and formal contractual arrangements. It is assumed that traders chose either contractual arrangements (RC) or spot-market transactions (SM) for supplies acquisition and for cereals sale. For example, Dioné (1989) reported that 47% of a sample

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of 62 traders in four cities used contractual arrangements to acquire cereals supplies in 1985. The same percentage of traders used contractual arrangements to sell grain (see appendix I). The types of investment retained for modelling purposes are investment in storage and cereals exports.

According to the theory of transaction-cost, a trader will adopt RC if it has lower transaction costs compared to SM. Thus, the formal model to be developed in subsequent chapters can be specified as follows:

CM = $F(X^i, Z^j)$, (i = 1,...n ; j = 1,....m), where CM refers to the observed coordination mechanism (RC or SM), X^i refers to the attributes of cereals transactions, and Z^j refers to the socio-economic characteristics of the trader.

The study assumes that the choice of coordination mechanisms precede traders' investment in storage and cereals exports. Thus, RC and SM enter the storage and cereals exports models as predetermined variables. This assumption is based on transaction-cost theory which states that contractual arrangements precede investment in dedicated assets defined here as investment with the purpose of serving a particular client (Williamson, 1985; Masten, 1991). An example would be investment in storage after a trader has signed a contract with a foreign client.

Another important assumption of this study is that the decision to invest in storage can be modelled as a two-step process. First, a trader decides to become an exporter when the returns to cereals exports are greater than the returns to selling in the domestic market. Once the decision to become an exporter is made, the trader decides on the quantity to store for shipment abroad. But, both the decision to become an exporter and how much to store for shipment abroad can be determined by different or the same factors: By modelling the decisions to store as a two-step process, one can test for selection bias by constructing

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inverse Mills ratios from the estimates of a probit model of the decision to become an exporter, and then using these ratios as explanatory variables in the stock equations.

1.3 Review of Past Studies

Past marketing studies in Sub-Saharan Africa have used the model of perfect competition as the norm, and the interest has been on the implications of the departure of observed market arrangements from perfect competition for spatial and temporal arbitrage. The tendency has been to evaluate observed coordination mechanisms in terms of pricing efficiency and to treat these coordination mechanisms as exogenous to the model of the researcher. However, many researchers have questioned the relevance of this approach to the study of the dynamics of food system coordination in developing countries (Shaffer et al., 1983; Staatz, 1984). At issue is the ability of the approach to analyze the effectiveness of observed coordination mechanisms to promote agricultural growth through increased investment in demand- expansion activities for agricultural products.

Studies based on the traditional approach have found indigenous marketing systems to be efficient in a static-equilibrium sense (Staatz, 1984). Yet these systems have been found to be "passive, accepting the marketed surplus rather than identifying potential markets and promoting production to supply them" (Shaffer et al., 1983). For indigenous marketing systems to contribute to sustained agricultural development, they must expand transaction opportunities for both farmers and traders beyond the restricted circle of acquaintances (Bromley and Chavas, 1989). This requires a system-wide adoption of alternative coordination mechanisms that reduce transaction costs associated with transacting with partners outside the circle of immediate acquaintances.

The tendency of marketing research in developing countries has been to analyze how the observed coordination mechanisms and market structure can result in how prices

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differing among markets by more than transportation cost and how prices differing over time by more than storage cost (Shaffer et al., 1983). The focus has been on the role of prices in the coordination of production and consumption over space and over time (Marion et al., 1985). However, in Mali as in many developing countries, information is imperfect and agricultural prices carry little coordinating information (Shaffer et al., 1983). Thus, coordination mechanisms other than just prices may be necessary to encourage traders to invest in demand-expansion activities and to handle the risk attached to such activities even if these coordination mechanisms may depart from those of the perfect competition (See Marion et al., 1985). Indeed, Staatz (1984) argues that the main issue in the agricultural development process may not be the generation of competitive equilibria, but using the rents generated from disequilibria efficiently in productive investments (Staatz, 1984).

In Mali, following the market reforms that led to increased competition, marketing margins along major trading routes dropped between 1986 and 1992 (Staatz and Dembélé, 1993). Yet, real producer prices have fallen during the same period because of increased production that confronts a limited domestic market demand. According to Handy and Padberg (1971), "Organizational imperatives for physical [pricing] efficiency are different from those of product progress". Furthermore, Shaffer et al. (1983) stated that "pricing efficiency deals with already marketed surplus; it says little about effectiveness of coordination or contribution to increased productivity." Yet, marketing research in developing countries has ignored the determinants of coordination mechanisms and the effectiveness of observed coordination mechanisms to promote agricultural growth through expanded trading opportunities. Indeed, Marion et al. (1985) argued that economists have given little attention to vertical coordination.

David C. Wilcock, in his dissertation entitled "The Political Economy of Grain

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Marketing and Storage in the Sahel", provides a summary of the main findings of the various marketing studies conducted during the 1960's and the 1970's. According to Wilcock, spatial price differences were found to be greater than transportation costs during the 1960's and the 1970's. Spatial arbitrage was found to be inadequate, and islands of competitive markets were poorly integrated. Marketing studies in Mali, conducted after the market reforms in the early 1980's, also found that some markets were better integrated than others (Mehta, 1989; Camara et al. 1992).

Cereals marketing inefficiencies in Sub-Saharan Africa have been explained by many factors. Wilcock argues that poor information, risk-averse behavior of cereals market participants, and weak physical and institutional infrastructure explain most of the inefficiencies in spatial arbitrage. In the Malian cereals subsector, the weak physical infrastructure includes poor road infrastructure, while the institutional factors identified by researchers include the lack of an adequate grading system, unforceability of contracts, lack of access to formal credit markets, and unpredictability of food policy changes (Mehta, 1989; Camara et al., 1992; Steffen, 1992).

Coordination failures that constrain traders' ability to deliver grain on time and according to quality requirements of both domestic and foreign clients may explain the failure of storage and export expansion programs in Mali. According to Harrison et al. (1974), instability of supplies from rural assemblers is likely to constrain the ability of wholesalers to engage in large-scale export operations. In addition, if wholesalers are uncertain about semi-wholesalers' and retailers' demand, they are likely to invest less in inventories and in the expansion of marketing facilities. In return, irregular supplies from wholesalers prevent both semi-wholesalers and retailers from expanding their investment and scale of operation (Harrison et al., 1974). Thus, coordination failure constrains traders'

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ability to invest in market expansion activities. Yet, there is no empirical research on the constraints to the adoption of effective operating practices and institutions to improve coordination in most developing countries.

Little is known about the factors that affect Sub-Saharan African traders' choice of particular coordination methods to reduce marketing uncertainties. In addition, the relationship between the types of coordination methods adopted and traders' investment behavior has not been researched. Indeed, most of the recent marketing studies in Mali have emphasized pricing efficiency and the impact of market concentration on producers' and consumers' welfare. The focus on marketing efficiency of the early studies was justified because the government and the PRMC were more concerned about the cost-effectiveness of the distribution of cereals during the deficit years to help hold down consumer prices.

With surplus production, the need to expand market demand through traders' investment in storage and cereals exports may call for organizational arrangements that are different from those required for improvement in the efficiency of cereals distribution in the domestic market. For example, the risk associated with demand-expansion activities of cereals exports may be higher than the risk associated with the distribution of grain in the domestic market. Therefore, large-scale operations may be necessary to cope with the high risk associated with demand-expansion activities, and the resulting market structure may be more concentrated than the atomistic competition that characterizes the domestic distribution of grain.

The organizational, coordination mechanisms, and scale requirements of a private marketing system capable of expanding market opportunities in response to increased cereals production have not been researched in Mali. However, the long-term effects of organizational failure (i.e., depressed prices, resulting in reduced incentives for producers

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to invest in new technologies and to expand cereals production in regions where cash crops are not available) constitute a growing concern for the Malian government. Indeed, most of the early sale of grain at harvest is done by farmers in regions where cereals are the only crops (Cebron and Sanogo, 1991). For example, Dioné (1989) found that farmers made 16% of their grain sales at harvest in the cotton-producing zones against 58% for farmers in regions where cereals are the only available crops. Moreover, in the absence of cash crops, the obligation for farmers to pay back their debts at harvest explains 80% of the early sales (Cebron and Sanogo, 1991).

Most of the on-farm storage of grain that is eventually marketed is done by fewer than 30% of the well-equipped farmers, who account for 90% of net sales in zones where cash crops offer an alternative to selling cereals at harvest (Dioné, 1989). Furthermore, regions with cash crops are well-served with good roads that make the transfer of grain possible all year round. Regions that do not grow cash crops lack adequate roads during the rainy season, even if they account for the bulk of marketed surplus[2]. Consequently, better-off farmers who hold stocks in these regions may face low returns to storage.

Coordination failure in the cereals subsectors has other impacts on the rest of the economy. First, the lack of a reliable market for cereals in rural areas for those who want to buy grain both endangers food security and reduces the incentives for specialization. Hence, increased productivity from specialization of the economy is lost. Second, because cereals are a major wage good, their price affects the cost structure of the economy and

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[2]. The production data reveals that the region of Sikasso, which produces the bulk of Mali's cotton, contributes between 15% and 22% for total national production of millet and sorghum. Farmers in Sikasso market between 8% and 10% of their cereal production. In contrast, the regions of Segou and Mopti, which do not grow rice and major cash crops, contribute 47% total national cereal production. Farmers in these regions market up to 30% of their cereal production (Cebron and Sanogo, 1991).

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hence its competitiveness in international markets. To the extent that poor marketing arrangements raise the price of cereals to consumers and increase the instability of grain prices, that higher price level and instability affect the average wage and the real exchange rate. This, in turn affects the economy more broadly. In the long run, the level of average wage is a function of the prices of cereals (Delgado, 1993).

The reliance of the government on the flexibility of private-sector management "to increase the flexibility of the agricultural economy by making it more responsive to shifts in comparative advantage through rapid adjustment of the production mix and the absorption of technical advances" (Kydd and Scarborough, 1989) depends largely on the ability of the private marketing system to adopt new practices and institutions that improve coordination and investment. Adoption of new practices and institutions by traders that improve vertical coordination would reduce transaction costs and stabilize market arrangements that reduce marketing risks. Reduction of marketing risks would allow investment and more efficient use of existing capital through timely scheduling of transportation, handling, and storage facilities (Harrison, 1974). Such investment would result in increased productivity in the marketing system and improved incentives for producers in the long run.

However, Kydd and Scarborough (1989) argue that "the private sector's capacity to take over domestic food marketing systems has in many [African] countries yet to be conclusively established." Moreover, marketing research has avoided the important question of the effectiveness of the market as a coordination mechanism (Shaffer, 1973). With the new concern about stable prices and expanded market outlets, information on the constraints to the adoption of effective coordination mechanisms that promote traders' investments and provide adequate incentives to producers to invest in cereals production

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1.5. Sources of Data

Most of the data used in this study were collected under the Malian component of the MSU-USAID Food Security in Africa Cooperative Agreement and covered the period of 1985 to 1989. Additional data were collected from March to July 1992, thanks to a grant from the Rockefeller Foundation. The Malian component of the Food Security Research Project was linked to the Malian Commission Nationale de Suivi et d'Evaluation de la Stratégie Alimentaire (CESA) to develop within the Malian government the research capabilities to monitor and evaluate the on-going policy reforms related to food security. The project had a producer component and a trader component. The objectives were to evaluate empirically the main assumptions of the policy reforms and to provide up-to date information about the major constraints preventing farmers and traders from responding effectively to these reforms.

1.5.1. Design of the trader component of the research

The cereals market reformers assumed that traders would seize the opportunities opened by market liberalization. As a consequence, marketing margins would decrease through increased competition and traders would invest heavily in marketing infrastructure. To check these assumptions, the research was designed to evaluate the following factors:

a) **Traders' perceptions of the permanence of the market reforms.** Traders' perception of the durability of the reforms was hypothesized to affect the traders response. If traders perceive the reforms to be transitory, they are likely to invest less in the marketing system. In contrast, if traders perceive the reforms to be permanent, they are likely to have long-term expectations about new trading opportunities and to invest· in marketing infrastructure.

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b) Traders' ability to bear and manage risk. Cereals transactions in the Malian context are risky. These risks result from weather-induced production instabilities, government food-aid distribution, regulatory uncertainty, and the inability of traders to enforce contracts. Depending on traders' ability to bear and to devise risk-sharing mechanisms through improved coordination methods, their response to the reforms will vary.

c) Traders' access to additional resources. Most trading activities in Mali rely on self-financing. Few traders have access to formal credit sources and must rely on informal capital markets. However, these informal markets charge high interest rates. Thus, unless the return to cereals marketing is very high, traders' response to market reforms will be limited. Hence, traders' ability to invest in working stocks and marketing infrastructure is contingent on their access to formal credit.

1.5.2. Selection of traders and the major variables

Secondary price data were analyzed to identify wholesale markets in the main cereals surplus zones that were integrated with major urban centers in deficit zones. The assumption was that any production response from the reforms would come first from the surplus zones of high potential. Initially, two wholesale markets were selected from the southern part of the country, namely Koutiala and Sikasso. Bamako, which is the main urban consuming center, was selected along with Mopti, which imports cereals from the South and supplies the deficit Northeast. Later, Segou, which is located in a surplus zone, was added along with Tombouctou and Gao, the two main urban centers of the deficit North.

In all cities, a census of all identified wholesalers was carried out. Traders were classified as semi-wholesalers or wholesalers, based on their scales of operation. The traders were then stratified into four groups: Traders who entered the cereals trade before PRMC, traders who entered the trade after PRMC, specialized traders and non-specialized traders. In addition to these stratification variables, the census recorded resources owned, origin of the traders' capital, age, sex, education level, other activities beyond trading, and job experience.

Two types of questionnaires were used in the survey, and enumerators recorded answers through direct interviews. One-shot questionnaires were used to collect data on socio-economic and policy variables, while on-going questionnaires were designed to record monthly cereals transactions and prices. Data entry was performed regularly as question-naires were filled out and checked. Timely preliminary data analysis was performed, and the results were widely disseminated and discussed with policy makers. Feedback from policy makers was then used to identify new data needs for future one-shot surveys.

1.6. Organization of the dissertation

This dissertation is organized into six chapters. Chapter II discusses the conceptual framework of the study. Chapter III describes the structure of the cereals subsector. Chapter IV describes the physical and institutional setting of the cereals trade and analyzes the evolution of traders' investment in marketing in storage and trucking capacity. Chapter V analyzes the factors that affect traders' choice of alternative coordination mechanisms and the relationship between coordination mechanisms and traders' investment in storage and cereals exports. Chapter VI summarizes the main findings of the study and presents policy conclusions.

Chapter II

2. Conceptual framework

Policy actions always proceed from a world view of the objectives and decision process of the actors whose behavior the policy intends to change. Indeed, without an understanding of the objectives and decisions processes of the actors, how can their behavioral responses be predicted in response to policy change, and how policy-makers decide which variables to alter to achieve some given objectives? Thus, one key role of policy-relevant social science research is to identify the correct conceptual framework wherein a model of the objectives and decision process of the actors can be derived (Hoover, 1984).

A conceptual framework is a tool that guides and organizes inquiry. It gives special significance to concepts and variables and permits the ordering of the dispersed elements of the given universe under investigation in a meaningful way (Hoover, 1984). In social science research, it is a theory that isolates those variables that are thought to be significant in explaining human behavior. In the Malian context, where policy-makers seek to induce traders to invest in cereals stock and export operations in order to raise producer price, it is important that the factors or variables that influence the decisions of traders to invest be understood along with the objectives they pursue. Thus, the choice of a conceptual framework is function of the nature of the research problem to be addressed.

The inadequacy of traders' investment in storage and export operations to expand cereals demand constitutes the principal research problem of this study. The objective of the chapter is to use the transaction-cost framework in the tradition of Williamson to analyze the issues of coordination within the Malian cereals subsector. The first section deals with the issue of food system coordination in agricultural marketing research. The

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second section provides a brief review of the concept of transaction-cost economics and its limitations. The third section derives the range of governance structures available to traders by applying the transaction-cost framework to the realities of the Malian cereals subsector.

2.1. Food system coordination as a marketing issue

Coordination, viewed as a set of activities used to harmonize stages in the cereals subsector, is amenable to economic analysis. Indeed, historical states of coordination can be compared to an ideal state where supply and demand are matched at stable prices that reflect the opportunity cost of resources. Departures from the ideal state can be identified and the effects of alternative coordination mechanisms on given performance criteria can be predicted (Marion et al., 1985). The main problem with this approach is that the observed state of coordination can diverge from the ideal state because of differences between the researcher's performance indicators and those of market participants who perform the coordination activities, or from constraints to coordination outside the control of market participants (Ibid.). Despite this drawback, this study uses economics analysis to analyze coordination within the Malian cereals as a problem of using scarce resources to achieve desired goals.

2.1.1. Coordination as a problem of resource allocation

Marion argues that agricultural marketing research has given little attention to the study of food system coordination. Coordination is defined "as activities or processes employed to harmonize stages." (Marion et al., 1985). This lack of focus on food system coordination may stem from the widely held belief that the adequate marketing arrangements will spring up automatically to coordinate supply and demand (Harrison et al, 1974). However, coordination decisions of market participants are like those of farmers and are influenced by incentives, the flow of information, and management alertness and ability

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(Marion et al., 1985). Thus, marketing research needs to pay more attention to the issues of adequate incentives, availability of information, and managerial talent as they affect the ability of the marketing system to coordinate supply and demand over space and time.

The activities employed to harmonize stages within the food system consume real resources and involve risk for which market participants expect compensation. Indeed, specialization within an economy requires that an increasing share of the resources of the society be engaged in coordination (North, 1990). Thus, coordination must be viewed like any economic activity that employs limited resources to achieve some desired ends (Marion et al, 1985). Consequently, the study of economic coordination must be interested in the cost, benefit, and risk to market participants of using alternative coordination mechanisms to bring into harmony the different stages of the food system.

The synchronization of the different stages requires that the preferences, actions, and decisions of the different participants be brought into harmony. The question is what transaction mechanisms as coordination mechanisms will synchronize the different stages and at what cost and risk to different market participants. Indeed, economic transactions involve the cost of searching for buyers and sellers, reaching agreement on the terms of exchange, exchanging commodities, transferring property rights, extending credit, and enforcing agreements reached. Accordingly, different coordination mechanisms will have different cost structures and risk distributions for different participants.

When the distribution of costs and benefits of coordination mechanisms is perceived as unfair by participants and risk is assigned to those unable to bear it, goal conflicts will arise and market participants will fail to cooperate. Accordingly, the resources allocated to coordination may not be socially optimal. Thus, the socially optimal allocation of resources to coordination depends on the effectiveness of alternative transaction mechanisms as ways

for market participants to articulate and harmonize their preferences, to assign risk to those able to bear it, and to provide returns consistent with the opportunity cost of resources.

2.1.2. Traditional approach of agricultural marketing research to food system coordination

Agricultural marketing research has tended to deal mainly with the issues of fair dealing, competition and pricing efficiency of the food systems. Generally, the focus has been on improved efficiency that could reduce marketing margins and increase the returns to farmers' resources while benefitting consumers at the same time. As a consequence, agricultural research has been tempted to rely heavily on the conceptual insights of price theory. Indeed, the theory of monopolistic competition, along with other price concepts, have provided the analytical framework to marketing researchers to predict the allocative consequences of the departure of observed marketing structures from the ideal competitive model of neoclassical economic theory.

The core behavioral assumptions of price theory state that economic agents have rationality that leads them to maximize an objective function subject to constraints. The role of the researcher is to identify the objective function of the economic agents, the constraints they face, and to derive the optimal choices (Eggertsson, 1990). This process involves the specification of assumptions about the type of information available to the agents and the type of interactions they face (Ibid.). For example, the perfect competition model is derived with the assumption of perfect information, resource mobility, absence of economies of scale, and a large number of interacting agents.

When perfect competition obtains, economic agents are assumed to maximize profit subject to the constraints of the available production technology and the prices of input and output. Accordingly, perfect competition limits completely the discretion of economic agents in setting inputs and outputs prices, and the price mechanism is able to coordinate

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effectively the actions of the multitude of agents involved. With competitive interaction, equilibrium outcomes are optimal and unintended as economic agents maximize at every margin and exhaust all possibilities of earning marginal returns above the opportunity cost of resources.

The ability of prices to coordinate production and consumption efficiently when economic agents interact competitively, has led agricultural researchers to posit the competitive market exchange model as the norm against which the outcomes of all coordination mechanisms are evaluated. However, depending on the assumptions of the researcher regarding the availability of market information and the number of economic agents who interact, the coordination mechanisms can range from spot-market transactions where different stages in the food system are linked by prices to administered transactions where allocation decisions are set within a single firm (Marion et al., 1985). Thus, the assumptions made by the researcher about the type of information available to economic agents and the type of interaction are critical in evaluating the efficiency of the operation of observed coordination mechanisms.

As farmers started to outproduce effective demand in many developed countries during the early 1960s, the issue of effective coordination gained center stage in agricultural research. At the same time, increased administered transactions, food safety, and environmental degradation have led researchers to raise the issue of market failure. Market failure is characterized by a gap between social and private cost and may result from incomplete information, the absence of contingent markets, and the failure of economic agents to internalize all the consequences of their actions.

The focus on surplus and market failure has led agricultural research to broaden the dimensions of market performance in order to address the issues of effective coordination,

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concentration, food safety, and environmental degradation. Accordingly, the theory of industrial organization, developed by Bain in 1957, has been extended to the subsector approach to agricultural marketing studies developed by Shaffer (1980). The objective of the subsector approach to marketing studies is to gain a broader perspective of the production and marketing of the food system as a whole. Indeed, a subsector represents a set of vertically and horizontally related economic activities that deals with related commodities. The subsector approach emphasizes the vertical value adding process in the food system, where production and marketing are no longer analyzed separately. The approach was expended to the structure-conduct-performance (SCP) framework by the work of NC-117 Committee for the study of the US food industry in the 1970s and 1980s.

The SCP framework postulates that market structure strongly influences the behavior of firms, which in turn influences market performance. Market structure refers to those characteristics of the organization of a market that influence the competitive behavior of firms and pricing efficiency, such as number of firms, entry and exit conditions, degree of product differentiation, technical change, and changes in capacity and capacity utilization. Performance indicators include, among other things, technical and operational efficiency; food safety; the extent to which supply matches demand preferences in terms of quantity, quality, timing and location; progressiveness; and conservation of natural resources.

Although the SCP framework has broadened its performance criteria by including vertical coordination, researchers still tend to focus on barriers to entry or collusive practices in order to determine the allocative efficiency of observed market structures which are taken as given. Vertical integration and diverse contractual arrangements are not generally evaluated in terms of improved coordination. However, the lack of adequate information flow, transportation network, and limited capital results in market failure in many

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developing countries, and firms may need to achieve a certain scale before they can improve coordination. Consequently, there is a need to evaluate marketing arrangements in terms of improved coordination, specifically in developing countries, where market failure may be the rule.

2.2. Application of the transaction-cost framework to analyzing economic coordination

The insistence of the SCP framework that strategic behavior of firms, increasing returns to scale, and economic power are the sole forces that drive vertical integration and other contractual arrangements may limit its relevance to the study of coordination issues. Thus, there is a need for complementing the SCP framework perspective with other conceptual insights to address coordination issues in the food system of developing countries. The emerging transaction-cost conceptual framework, with its emphasis on the management of economic agents' interdependence in the process of coordination and on a variety of problems and limitations of market-mediated transactions, offers new perspectives for agricultural research (Marion et al., 1985). Indeed, the transaction-cost framework attempts to derive the optimal coordination mechanisms or governance structures by relaxing the assumption of the simple price theory of costless information and by adding the constraints of positive transaction costs. Although there exists many perspectives on the transaction-cost framework, this study adopts the approach developed by Williamson, which focuses on the different cost of alternative coordination mechanisms and the concept of the subsector.

2.2.1. The concept of transaction-cost and economic coordination

Williamson argues that transaction costs are the costs of running the economic system. Firms, markets, and mixed contractual modes constitute alternative institutions for organizing and coordinating economic activities at different costs. Price analysis takes these

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institutions as exogenous variables. In contrast, transaction-cost economics (TCE) views these institutions as endogenous and tries to explain the economic logic of why they differ from one type of economic activity to another even within the same legal context. TCE accomplishes this by relaxing some major assumptions of neoclassical price theory.

Neoclassical economic theory, in its simplest form, assumes full information and costless transactions between market participants as the standard model. With information and costless exchange, all forms of shirking would be eliminated and contracting in its entirety would prevail. The future can be predicted and all potential contingencies are accounted for at the ex-ante stage of transactions. Thus, adaptations to economic disturbances would be efficacious and would pose no serious problem since potential opportunistic behavior would be foreseen along with the potential outcomes of disputes. In such a world, the outcome of transactions would be certain and there would be no need for any fancy form of contract.

TCE relaxes the assumptions of full information and costless transactions of the neoclassical theory of price and examines the implications of incomplete information and positive transaction costs for the organization of economic activities (Eggertsson, 1990). Although a precise definition has yet to emerge, most economists define transaction costs as information costs that derive from human interdependence (Staatz et al, 1988). These costs include search cost, ex-ante contracting cost, contract monitoring cost, and ex-post contract execution cost. Thus, transaction costs reflect the scarcity of information as it interacts with human interdependence.

The development of the concept of transaction cost derived from the work of Coase (1937), with Chandler (1977) and Klein, Crawford, and Alchian (1978) as important contributors. Coase showed that there are costs associated with market-mediated

transactions such as information gathering and search costs. The firm as an institution exists to economize on these costs and reaches its limits at the point where there are no transaction-cost savings in bringing an additional transaction within the firm. Williamson (1985) extended the concept in his explanation of the choice of different alternative organizational arrangements that transactors use to minimize transaction costs and to secure all potential gains from trade.

The main contribution of Williamson was to relate the attributes of transactions to the choice of particular organizational arrangements given certain assumptions about human behavior. The first of these assumptions is bounded rationality, where agents are " intendedly rational, but only limitedly so" (Simon, 1961, xxiv). Economic agents have an economizing orientation (maximization), but they are constrained by their ability to gather, retrieve, process information, and to foresee the future. TCE postulates that economic agents will assign transactions to governance structures that minimize transaction costs and provide flexibility for adaptation to contingencies. However, the choice of the appropriate governance structure is constrained by the degree of opportunism present in the transaction environment.

Opportunism is defined as "self-interest seeking with guile" (Williamson, 1985, 47). Opportunism poses serious problems for economic organizations because of the behavioral uncertainty that results from "self-interest seeking with guile". Thus, the governance structures that provide appropriate safeguards ex-ante to secure credible commitments and to promote efficient adaptation while economizing on the costs of reaching agreements and resolving disputes will be favored by transactors (Williamson, 1985, 48; Masten, 1991, 4). Bounded rationality and opportunism would pose few contractual problems if not for some certain attributes of transactions. The main attributes by which transactions differ are asset

specificity, uncertainty, and frequency (Williamson, 1985, 52). Asset specificity refers to investments whose value in alternative uses is lower than in the intended use. Johnson (1972) speaks of asset fixity as the condition where the salvage value of an asset is less than its acquisition value. Four types of asset specificity are generally identified: site specificity, physical asset specificity, human asset specificity, and dedicated asset specificity.

It is an accepted assumption of transaction-cost economics that specific investment lowers the cost of production. However, specialized assets earn quasi-rents, and the presence of bounded rationality and opportunism implies that transactors may try to capture these rents at the expense of the investors. These hazards raise the transaction costs of specific assets. To secure their quasi-rents, investors remove transactions supported by specific investment from the market and place them under special governance structures. The governance structures that limit behavioral uncertainty (opportunism) and allow adaptation at low cost to disturbances to the economic environment will win over competiting structures. The objective is to minimize both production and transaction costs.

The second attribute of transactions is uncertainty. Primary uncertainty results from the random acts of nature and the unpredictable changes in the economic environment and is state-contingent (Williamson, 1985, 57). In contrast, behavioral uncertainty results from the non-disclosure, disguise, or distortion of information with the intention to mislead (Ibid.). Both primary uncertainty and behavioral uncertainty are major sources of risk. But uncertainty alone would cause little problem for economic organization if not for the inability of society to adjust instantaneously to unexpected changes. It is this inability resulting from asset fixity that creates major risk for transactors. Thus, "The economic problem of society is mainly one of adaptation to changes in particular circumstances of time and space" (Hayek, 1945).

The need to adapt to contingencies would not arise if not for bounded rationality, since then it would be possible to prepare for those changes ex-ante. Also, effective adaptation is impaired because of the presence of opportunism (Williamson, 1985, 57). With bounded rationality and opportunism that makes adaptation costly, special governance structures emerge to support transactions and to reduce risk. But, as Williamson puts it, "governance structures differ in their capacities to respond effectively to disturbances." (Ibid).

The third attribute of transactions is their frequency. According to Williamson, "The cost of specialized governance structures will be easier to recover for large transactions of a recurrent kind. Hence the frequency of transaction is a relevant dimension." (Williamson, 1985, 60). This proposition implies that the cost of specialized governance structures designed to protect transactions supported by investment in specific assets may not be recovered if the market is small. To capture the benefits of specific assets supported by specialized governance structures, transactors need to increase the size of the market through recurrent transactions. This puts high value on the continuity of the trading relationships, and the identities of the transactors become important or mechanisms arise to permit repeated, reliable anonymous transactions (e.g, third-party contract enforcement or adjudication).

The basic proposition of transaction-cost economics states that transactions differ in their attributes and these differences explain why some transactions are organized one way and other transactions another. The task of the researcher is to identify those attributes of transactions that influence "the relative efficiency of various organizational forms" (Masten, 1991, 9). These forms are called governance structures, and the terms of governance can be explicit or implicit. When the terms are implicit, they originate from

common practice as defined by law, social norms, and standard operating procedures (SOPs). Williamson (1985) identifies four types of governance structures: market exchange or classical contracting, trilateral relationship, bilateral relationship, and unified governance structure or full integration through ownership. With market exchange, the terms are completely specified ex-ante and contractors do not expect adaptation beyond the explicit terms of the contract. Trilateral relationship appears when transactors entrust a third party with discretion to determine appropriate damages and adaptations according to a specified procedure (Kreps, 1990, 750). Bilateral relationship characterizes most of the marketing arrangements, where the two parties rely on their own ability to work things out as events unfold. Here, continuity of the contracting relationship is highly valued and transactors don't need to spell out at the ex-ante stage of their relationship how adaptations will be made to circumstances as they arise. Each transactor is willing to cooperate with the other to preserve the trading relationship (Kreps, 1990, 751). Like trilateral relationship, bilateral arrangements vary according to the terms of the contract.

The last governance structure refers to unified governance and corresponds to the firm. Kreps (1990, 751) argues that unified governance structure occurs when one party retains most of the authority by law or custom to adjust the terms of the contract. An example of unified governance structure is the labor contract, where the worker carries out the instructions of the employer. However, the worker has the right to terminate the contract if he does not like the adjustments made by his employer. Vertical integration through ownership corresponds to unified governance, where the market interface between two adjacent stages in the value-adding chain has been replaced by administrative directives.

Once transactions are differentiated by their attributes, they must be matched to governance structures to minimize transaction costs. The question is: what governance

structures will minimize transaction costs? TCE states that when transactions are supported by nonspecific assets, there is no need for specialized governance structures and market exchange or classical contracting is sufficient to support transactions. Competition from the market limits opportunism, since alternative trading arrangements can be easily secured even if the trading relationship between the two parties is continuous (Kreps, 1990, 751).

With moderately specific assets, transactions are removed from the market and relational contracting becomes the dominant governance structure. Relational contracting refers to contractual arrangements between sellers and buyers for the exchange of goods and services outside the market. This includes trilateral relationships and bilateral relationships. When the relationship between the two parties is enduring, i.e, the transactions have high frequency, bilateral contracting is the favored governance structure. But for the bilateral relationship to work, Williamson (1985, 76) states that both parties must (1) recognize that the hazards of opportunism vary with the type of adaptation proposed and (2) restrict adjustments to those terms of the contract where the hazards of opportunism are least. For example, both parties to a contract are likely to agree more easily to a quantity adjustment than to a price adjustment.

The cost of relational contracting rises when transactions are supported by highly specific assets, since each party must engage in expensive ex-ante planning, monitoring, and enforcement of the transactions (Kreps, 1990, 753). At some point, the costs of transacting become so high that the transaction is brought under unified governance. This would be the case where variability in the quality of the product imposes great cost on one transactor and quality control is costly. However, unified governance structures are characterized by low-powered incentives, i.e., employers have difficulties to monitor the efforts expended by their employees and the care with which the employees use the equipment or handle the product.

Thus, the savings in transaction costs offered by unified governance structures must be balanced against the increased cost resulting from low-powered incentives.

2.2.2. Limitations of the transaction-cost framework

Although the theory of transaction-cost economics in the tradition of Williamson can be applied to a wide range of economic organizations, it presents some limitations. First, the theory gives little emphasis to the importance of court adjudication and relies on the efficiency of private governance. The main proposition is that private parties will derive the optimal mix of hierarchies and market that will minimize transaction costs with adaptive, sequential decision making, and dispute settlement capacities. However, this proposition assumes cooperation and ignores goal conflicts and power struggles among transactors.

When goals conflict, cooperation will break down unless one party has enough legal power to make his goals effective (Schmid, 1987). For example, when spot market price rises, traders from producing zones are tempted to break their contractual obligations to take advantage of the price rise, while their clients want timely delivery at the old price to benefit from the same opportunity. The fact that traders from producing zones and their clients may be able to settle their disputes without recourse to the courts does not mean that court ordering is not efficacious. The mere knowledge by traders from producing zones and their clients that their property rights will be enforced should they fail to adapt to the new circumstances is enough to limit opportunism (Hodgson, 1988).

The second limitation of the theory of transaction-cost economics is its insistence on lowering transaction-cost as sole criterion for institutional choice. However, whose cost counts depends on the structure of property rights (Schmid, 1987). For example, when most transactions are carried out through contractual arrangements, some transactors are denied access to sources of supply and must face volatile prices in thin markets. Also, the lowering

of transaction-cost as sole criterion of institutional choice ignores the drive for market power through strategic takeovers and vertical integration. Another limitation from the perspective of this study is that the theory can easily give an efficiency justification to the existing institutional choice. However, the selection process that performs the sorting between more and less efficient institutional forms is not explained by transaction-cost economics. For example, the governance structure that minimizes transaction cost in the short-run may be too rigid to adapt efficiently to long-term changes in demand and supply conditions. Thus, short-term cost minimizers are not necessarily long-term cost minimizers. So a key conceptual issue is the rate of time preference (discount rate) of the various actors. If the discount rate of the key private actors is higher than the appropriate social discount rate (e.g., due to liquidity constraints resulting from an overvalued exchange rate), then one can't expect the governance structure that emerges from the market to be socially optimal.

Despite the above limitations, the transaction-cost framework can be adapted to model the Malian cereals subsector. This adaptation requires that one takes into account the state of the supporting institutions of cereals transactions. For example, the smooth flow of cereals between producing zones and consumption centers requires a well-developed transportation and communication infrastructure, the availability of trade finance, and a well functioning court system that protects property rights. In addition, the variability and the scale of cereals production must be examined carefully in order to understand the observed marketing arrangements. Indeed, the tranaction-cost framework seems to be better suited to an industry where transactors have control over the flow of production, in contrast to agriculture where weather determines the level of production.

2.3. Adaptation of the transaction-costs framework to the Malian cereals market

The main extensions made to the transaction-cost framework are the differential access of certain transactors to capital markets and the court system of contract enforcement, the basic conditions of cereals supply and demand, and the state of the transportation and communication infrastructure. The basic assumptions of bounded rationality and opportunism of transaction-cost economics are retained. These extensions alter the predictions of the standard transaction-cost framework about the coordination mechanisms available to traders.

2.3.1. Determination of governance structures in the Malian cereals market

The main attributes of cereals transactions are uncertainty, asset-specificity, and frequency. These attributes combined with bounded rationality, opportunism, the structure of production and demand, the state of transportation and communication, and differential access for certain traders to capital markets and the court system determine the availability of governance structures. However, these governance structures may vary by regions and stages of the marketing system because of the variable pattern of production by region and differences in scale between stages.

Uncertainty

Uncertainty constitutes the most important attribute of cereals transactions. Risks in the cereals market are associated with uncertainty in supply, demand, general economic conditions, and legal and policy uncertainty. Cereals production varies greatly from year to year due to the irregularity of rainfall. As a result, rural supply is unpredictable and unreliable and results in high risk associated with using commercial stocks to even out production variation. In contrast, foreign sources of commercial imports are more reliable and more stable. However, food import policy tends to change from year to year depending

on the level of domestic production. This policy instability and the lack of coordination between commercial imports and food aid distribution create major risks for traders engaged in international markets.

Behavioral uncertainty constitutes another source of risk in the marketing environment. It determines the transaction costs of getting information about the creditworthiness of fellow traders, negotiation, monitoring, and enforcement of contracts. The major risks associated with behavioral uncertainty include loss from bad debts, loss from broken contracts, and the loss imposed by agents. The risk associated with the use of agents is particularly important for rural wholesalers who may have to pre-finance many rural collectors in order to assemble a truck load of grain for shipment in urban centers. Indeed, the collectors may turn the capital received over many times before delivering the grain, they may use the money to cover unforeseen expenditures, and they may not disclose the true price at which the grain was collected.

The agency problem also arises in inter-regional trade because traders from producing zones cannot be present at the same time in all of the urban markets where they trade and because the large scale of the transaction requires extension of credit. Thus, these traders need reliable partners who will receive and sell shipments and collect the debts that arise from the extension of credit. The choice of reliable collectors and partners in urban centers involves costly search and evaluation of fellow traders. This cost may even be higher when traders want to enter export markets because they will need to travel to prospect for eventual partners. Additionally, the cost of contract enforcement in foreign countries may be prohibitive.

Asset-specificity

The risks associated with the different sources of uncertainty identified above would pose little concern if market participants could adjust instantaneously to unexpected changes. The inability of market participants to adjust results from the length of time required to turnover a given stock of cereals in which capital is tied up and the limited alternative uses to which most traders can put their labor, experience, and knowledge. The longer the length of time required for traders to turn over their stock, the greater the risk because of adverse price change due to unpredictable changes in demand and supply conditions.

With limited alternative employment opportunities, trading becomes the major mean of earning income for most traders. As a result, a larger share of human and physical capital and labor of these traders is tied up in specialized trading activities at different stages of the marketing chain. This does not mean that traders have to transact solely cereals. Indeed, most of these traders handle a variety of agricultural products. The important point here relates to the fact that traders have very limited alternative uses for their skills to earn a living.

The specificity of assets in cereals transactions stems from the length of turnover or dedicated investment in stock, the special trading skills of traders who lack alternative uses for their skills, and the set-up cost of trade channels. When a rural assembler invests in stock prior to a commitment from an urban wholesaler, he acquires dedicated assets and faces losses should the urban wholesaler refuses to pay the agreed upon prices when demand drops. Traders who acquire specific human capital through experience and specialization in trading activities at different interfaces of the marketing chain, earn quasi-rents because returns to this form of human capital are lower in alternative lines of activities.

The movement of cereals between producing zones and urban centers requires the establishment of trade channels that enable traders to be in constant communication with each other. However, the establishment of these trade channels requires that traders expend resources and their time. These investments are worthless should traders who have expended the necessary resources and their time turn to alternative lines of activities. The trade channels enable traders to be always aware of the sources of supply on the one hand, and on the sources of demand on the other. Within these trade channels, arrangements are provided to finance the exchanges of cereals between the different stages of the marketing chain, for making payments and extending credit, and for assuring the frequency of cereals transactions.

Frequency

The frequency of transactions is particularly important since it relates to the length of turnover. Increased turnover leads to frequent transactions. These frequent transactions carry high risks if fellow traders cannot be trusted and credit must be extended to suppliers or buyers. When frequent transactions are supported by the spot market, the cost of searching new buyers or sellers for every transaction may be prohibitive for small lots. Spot-market transactions between producing zones and urban centers may be impossible for some scale of operations given the high cost associated with the stay of the rural assembler in urban centers.

The proper mix between contractual arrangements and spot market to support frequent transactions will depend on the costs associated with spot-market price variability and the transaction costs of contractual arrangements. According to Carlton (1976), the more variable the spot-market prices, the more costly the search and the more variable the cash flow. These costs make contracts more appealing to firms. However, the savings that

results from the use of contracts must be evaluated against the transaction costs involved in contracting.

Differential access to capital markets and the court system

In most developing countries, capital markets are imperfect because of the high information cost of determining borrowers' ability to repay. The banking system faces higher information cost in assessing the credit-worthiness of traders who do not have accounting records, investment plans, and stable returns to their investments, and who are subject to high bankruptcy rates. Furthermore, handling costs are greater for many small loans than for a few large ones.

The high information and handling costs lead to capital rationing and to the near exclusion of the small-scale trade from the formal capital markets. Thus, small-scale traders must rely on retained earnings and the informal capital markets for working and investment capital. Traders with limited retained earnings who lack access to capital markets are constrained in their ability to integrate vertically through ownership. Furthermore, they cannot engage in contractual arrangements that call for initial important investments in cereals stocks for future delivery.

The large-scale trade enjoys easier access to formal capital markets because of its adoption of standard accounting practices, investment planning, the large size of loans requested, and the availability of collateral. Accordingly, the large-scale trade has the necessary resources to integrate vertically through ownership and to bid for contracts that require advance large investment in cereals stocks. Thus, the differential access to capital markets means that certain traders have differential access to different governance structures to minimize transaction costs.

The small-scale trade also faces limited access to the court system of contract enforcement because of the small value of its claims. Indeed, in Mali as in most developing countries, the cost of using the legal system can easily exceed the total value of the claim. As a result, the small-scale trade must develop its own institutions that serve simultaneously to lower the cost of information in exchange and to substitute for the court system of contract enforcement. This limits marketing opportunities to a small network of known relationships, and spot-transactions become the only available governance structures in dealing with fellow traders outside the network of relationships.

The large-scale trade, with the value of its claims far in excess of the cost of the legal litigation, can afford the use of the court system of contract enforcement. Traders with assured access to the court system of contract enforcement can expand their contracting opportunities by engaging in long- distance trade and by entering into various contractual arrangements. They are freed from uncertainty and the need to expend additional resources to monitor constantly their partners as long as they are assured to be fully compensated when a contract breaks down. Thus, these traders can concentrate on the sale of their stocks with the assurance that the contracted quantity will be available or that they will be fully compensated in case of default.

Structure of supply and demand and the state of the transportation and communication infrastructure

Cereals production is carried out by a multitude of small-scale producers in the semi-subsistence sector. These producers are dispersed over wide geographical areas, and production varies greatly from year to year due to the irregularity of rainfall. Thus, rural supply is unstable, and farmers sell in small, fragmented, dispersed quantities that must be pulled together into units of viable size for shipment in urban markets. The lack of a

grading system also means that each small quantity must be individually inspected to determine its quality.

The instability of domestic production and the unpredictability of rural supply are compounded by a poor transportation and communication network. Indeed, most rural areas are inaccessible during the rainy season and the lack of a reliable telephone system means that most market information must be transmitted through person-to-person contact. Furthermore, the poor quality of rural roads in most rural areas may exclude the timely delivery of cereals and the use of large trucks. In contrast, foreign sources of supply and demand and government purchases are large in scale and supported by modern communication systems of telephone, telegraphy, and fax machines. External sources of imports are more stable than domestic production while domestic demand is less variable than export demand of domestically produced cereals.

Urban consumers are dispersed and buy cereals in small quantities. Serving these consumers requires a multitude of retailers to provide the space and size utility demanded by consumers. Thus, the structure of domestic supply and demand requires labor-intensive marketing techniques in grain collection and urban retailing and limits vertical integration by ownership. Indeed, vertical integration by ownership would require centralized control and supervision of agents in each of the many villages or market places in urban markets. Such control and supervision of the many agents would be too expensive given the poor quality of communication and transportation. The instability of marketed surplus, the lack of a grading system, and the poor transportation infrastructure imply an irregular flow of small and uneven quantities of variable quality, which is less suited to the demands of formal contracting that requires regular flow of quantities of specific quality.

Imports, exports, and government purchases require large capital outlays and specific quantities of certain quality. Timely delivery and the obligation to meet product quality standards are the basic requirements of these markets. This lack of flexibility in contractual arrangements and the large capital requirements exclude many traders from these international markets. However, the structure of domestic production tends to restrict the ability of traders to connect the domestic and the export markets through vertical integration by ownership or through standard contracting arrangements.

The adaptation of the transaction-cost framework to the realities of the Malian cereals subsector reveals a limited range of governance structures available to traders to minimize transaction costs. First, differential access to credit and the court system, the structure of domestic supply and demand, and the state of the transportation and communication infrastructure limit the use of standard formal contracting that demand timely delivery of given quantities of grain of specific quality. Second, certain traders have no access to these standard formal contractual arrangements and must rely on informal contracting and spot-market transactions. Third, the structure of domestic production and the lack of a grading system tend to favor spot-market transactions instead of the standard formal contracting required for the connection of the domestic market and export markets. Fourth, the poor infrastructure and the structure of rural supply increase the supervision cost of agents. Therefore, vertical integration by ownership of many stages within the cereals subsector is limited.

The governance structures available to traders to coordinate the different stages of the cereals subsector are limited to spot-market transactions and informal contracting. However, spot-market transactions impose high risk on specialized investment that require future planning (Staatz et al, 1993). Thus, spot-market transactions may prevent

specialization and the realization of scale economies that are necessary to move Malian agriculture from a largely subsistence oriented system to a commercially oriented production. Although informal contractual arrangements have the potential to reduce transaction costs, they limit resource mobility by restricting the size of the market to a small network of known relationships.

Chapter III

3. Vertical Organization of the Cereals Subsector

The organization of the cereals subsector comprises a multitude of small scale cereals producers and the different marketing arrangements that connect producers to consumers. These marketing arrangements are influenced to a large extent by the structure of supply and demand. This chapter analyzes the basic characteristics of supply and demand of cereals and the resulting marketing structure.

3.1. Basic supply and consumption conditions

Millet, sorghum, maize, and rice constitute the main staple foods grown and consumed in Mali. The structure of millet and sorghum production has remained approximately the same over the last twenty years, while maize production in the CMDT zone and the rice subsector have witnessed technological change. The pattern of domestic cereals consumption has also evolved under the influence of rapid urbanization of the country.

3.1.1. Cereals supply

The country relies on two sources of supply: domestic production and external sources. External sources include commercial imports and food aid. Millet, sorghum, and maize come mainly from domestic production. Rice and wheat products constitute the bulk of imports and food aid.

Table 3.1 **Evolution of Cereal Production and Cereal Imports**

Years	Total Net Cere-al Production (1,000 T)	Total Cereal Imports (1,000 T)	Total Availability (1,000 T)
1978/79	1006	139	1,145.00
1979/80	938	108	1,046.00
1980/81	705	127	832.00
1981/82	884	125	1,009.00
1982/83	820	181	1,001.00
1983/84	700	296	996.00
1984/85	556	429	985.00
1985/86	1343	204	1,547.00
1986/87	1416	63	1,479.00
1987/88	1304	39	1,343.00
1988/89	1780	55	1,835.00
1989/90	1730	36	1,766.00
1990/91	1409	60	1,469.00

Source: OSCE (1989) and DNSI (1991)

3.1.1.1. Domestic production

Domestic production as a source of cereal supply faces three main structural constraints: inadequate resource base, instability of production, and unstable marketed surplus.

3.1.1.1.1. Resource base

Smallholders account for the bulk of cereals production in Mali. There were 280,000 farm households engaged in cereals production in 1960 with a total of 2,200,000 individuals engaged in that activity (Lecaillon, 1986, 17). These individuals represented 94 percent of the total active population of the country. In 1982, agriculture's share of the active population dropped to 79 percent under the influence of rapid urbanization (Ibid.). However, a census taken by IER in 1990 revealed that 457,249 farm households were still engaged in cereal production in 1990 (.

Smallholders in Mali face three major resource constraints: inadequate labor supply during some critical periods of the growing season, lack of technological inputs, and erratic rainfall patterns. According to Dioné (1989), the average farm household cultivated 4 hectares in 1986 in the OHV zone of Koulikoro and 6 hectares in the CMDT zone of Sikasso. In terms of labor availability, the number of workers per farm household averaged 7 in the OHV zone against 8 in the CMDT. The number of adult workers averaged 7 for the two zones. The average amount of farm land per worker was 0.57 hectare in the OHV zone and 0.85 hectare in the CMDT zone.

Few studies have been conducted on rural labor markets in Mali. The available empirical evidence indicates that the share of hired labor in total farm labor supply is small (Dioné, 1989). A recent survey by IER, as reported by Dioné, indicates that outside labor provided 9 percent of total household labor supply in the CMDT zone and 17 percent in the

OHV zone during the crop year of 1984/85 (Dioné, 1989, 376). This suggests that farmers in the OHV zone rely more on outside labor than do farmers in the CMDT zone.

Although there is no available data on farmers' labor constraints, it is largely accepted that labor rather than land availability is the primary limiting factor for the majority of smallholders (Sijm, 1992). Labor shortages seem to be very acute during the weeding and the harvest seasons. Labor markets are nearly inexistent in many rural areas. When these markets do exist, they tend to be seasonal. Indeed, most labor markets are active during the harvest season in cotton and rice producing areas.

Table 3.2   Available Family Labor CMDT and OHV (1986).

Demographic Characteristics	CMDT	OHV
On-farm population	12.8	12.6
Available household labor	8.1	7.4
Dependency ratio:		
Persons/active adult worker		
	1.8	1.9

Source: CESA-MSU Food Security Project farm household surveys, 1986.

The small share of hired labor suggests a rigidity of the productive structure of smallholders in the absence of labor-saving technology. Although animal traction removes the labor constraints of land preparation, seeding, and weeding, its possession is associated with the production of cash crops such as cotton and rice. Indeed, these two crops use 2/3 of the animal traction equipment in the country (Lecaillon, 1986). Dioné found in 1989 that 46 percent of the producers in the CMDT zone, which accounts for most of the cotton production, were fully equipped with animal traction against 16 percent in the OHV zone

(Dioné, 1989, 62). In addition to the lack of animal traction, the majority of cereal producers use practically no purchased nutrients such as fertilizer (Badiane et al, 1992).

. Beyond the lack of technology, the pattern of rainfall constitutes the main factor that affects greatly the productivity of smallholders (Lecaillon, 1986). The pattern of rainfall divides the country into five different agricultural zones. The Guinea zone in the extreme South covers 6 percent of the country with an annual rainfall of 1,300 mm. The Sudan zone, with one fifth of the country, has an average rainfall of 1,300 mm in the South and 700 mm in the North. The Sahel comprises the semi-arid South, with an average annual rainfall of 700 mm, the arid-North with an average annual rainfall of 200 mm, and the Delta along the Niger river in the fifth region of Mopti with 3 million hectares inundated by the floods of the river. The Sahara desert, which covers half of the country, has an average annual rainfall of less than 200 mm.

Annual rainfall is more variable in the Sahel and the Sahara desert than in the Guinea and Sudan zones (Steffen, 1992). The variability of the rainfall determines the types of cropping patterns observed in different parts of the country. Steffen identifies three cropping patterns: rainfed agriculture with millet, sorghum, and maize as the main crops; water recession agriculture that grows sorghum along the river banks of the Niger river and around the low-lying depressions or seasonal pounds; and irrigated and recession agriculture along the Niger River that produces most of the rice. Rainfed agriculture accounts for 86 percent of total cereal production, with irrigated and recession agriculture contributing for 14 percent (OSCE, 1989).

The Sahel, with its unstable rainfall pattern, accounts for 52 percent of total cereal production (OSCE, 1989). The Guinea and Sudan zones, with the more adequate rainfall level, produce 64 percent of the maize. Only 40 percent of milled rice is produced under

controlled irrigation in the Sahel. This distribution indicates that total cereals production will fluctuate with the variability of rainfall in the Sahel.

3.1.1.1.2. Variability of domestic cereals production

From 1960 to 1991, total cereal production grew at an average annual rate of 2.6 percent and reached an average of 1.4 million tons between 1974-75 and 1988-89 (see table 3.3 below). Yield increases contributed 1.6 percent to this growth rate, while area accounted for 1 percent. Maize production grew faster than the other cereals at 4.2 percent per year, followed by millet and sorghum at 2.5 percent, and paddy/rice at 2.3 percent.

The growth of cereal production has not been uniform between 1960 and 1990. Production stagnated during the 1960's and declined sharply during the 1970's. This decline resulted mainly from the severe drought of 1973. Since the 1980's, the growth of cereal production has been steady except for some drought years such as 1984-85. Between 1974-75 and 1988-89, total cereals production has been unstable, varying up to 23 percent around its mean. For example, during the drought year of 1980-81, production dropped to 900,000 tons. In contrast, during the good rainy agricultural season of 1988-89, cereal production reached the record level of 2 million tons.

For individual crops, the production of millet and sorghum has been the most stable, with a coefficient of variation of 22 percent during the period. These crops are followed by rice with 30 percent, and maize with 53 percent (see table 3.4). The stability of millet and sorghum production may reflect the introduction of drought resistant millet varieties in the Sahel.

Table 3.3   **Cereals production**

Years	60-65	66-70	71-73	74-79	80-84	85-89	90-91	Annual Growth Rate
Millet Sorghum								
Prod. (000'T)	870	780	660	895	835	1415	1306	2.5
Area. (000'ha)	1490	1270	1155	1275	1370	1670	1741	0.9
Yield. (kg/ha)	580	615	570	700	610	850	747	1.6
Maize								
Prod. (000'T)	85	85	55	75	85	210	191	4.2
Area. (000'ha)	105	85	110	105	95	145	150	1.9
Yield. (kg/ha)	820	1000	500	710	890	1450	1273	2.1
Paddy Rice								
Prod. (000'T)	165	150	135	225	145	260	294	2.3
Area. (000'ha)	145	160	145	180	145	200	240	1.2
Yield. (kg/ha)	1120	940	930	1250	1000	1300	1225	1.1
Total Cereals								
Prod. (000'T)	1120	1015	850	1195	1045	1885	1791	2.6
Area. (000'ha)	1740	1515	1410	1560	1610	2015	1861	1.0
Yield. (k/ha)	640	670	600	765	660	935	962	1.6

Source: Sjim, 1993

Although the Sahel contributes most to total cereals production, it is less productive

than the Guinea and the Sudan zone. Indeed, both Koulikoro and Sikasso, which belong

to the Guinea and Sudan zones, have the highest yields compared to the Sahelian regions

of Segou and Mopti. For example, the Sahelian region of Segou has an average yield of 950

kg/ha for millet against 1500 kg/ha for the regions of Sikasso and Koulikoro (OSCE, 1989).

Table 3.4 Variation of cereal production in Tons (1974/75 - 1988/89)

	Millet/Sorghum	Maize	Rice	Total Cereals
Average	1054980	112739	206722	1374441
Standard Deviation	232848	59530	61056	317305
Coefficient of Variation (%)	22	53	30	23

Source: OSCE (1989)

The difference in yields between the Guinea and Sudan zones and the Sahel may be

explained by the difference in land quality, rainfall pattern, and technology. Indeed, the

Guinea and the Sudan produce have the highest level of rainfall and the best lands (Steffen,

1992). Also, these zones produce most of the cash crops and have the highest percentage

of equipped farmers with animal traction. Moreover, millet and sorghum benefit from the

residual effect of fertilizer use in cotton production in the Guinea and Sudan zones (Dioné,

1989).

3.1.1.1.3. Marketed surplus

The level of marketed surplus depends on the level of production at the farm

household level and the cash needs of farmers. According to Broekhuis and Jong, as

reported by Sijm (1992, 13), 62 to 70 percent of farm households produced fewer than 150

kg of cereals per capita in 1988 in the Sahel compared to 47 percent in the southern part

of the Sudan zone. Although the literature generally assumes that 10 to 15 percent of total coarse grain production is marketed, Dioné found that farmers in the CMDT and the OHV zones marketed on average 8 percent of their cereals production.

Contrary to the findings of Dioné, Cebron and Sanogo (1991) report that producers sold 31 percent of their production during the good rainy year of 1988-89 and 11 percent during the bad year of 1989-90 in the region of Segou. The figures ranged from 7 percent in 1988-89 to 11 percent in 1989-90 in Koutiala in the Sudan zone. For Koro, located in the Sahel (Mopti), producers sold 11 percent of total production during the good year and 1 percent during the bad year.

Two patterns of marketed surplus emerge from the above figures. First, farmers in the Guinea and Sudan zones sell a small proportion of their total coarse grain production. In contrast, farmers in the Sahel who have no cash crop, sell a higher proportion of total production. Second, during bad years, the Sahel reduces its marketed surplus by 15 percent on average. In contrast, the Guinea and the Sudan zones tend to increase their marketed surplus by the same percentage.

With 52 percent of the total national cereal production, the variation of marketed surplus in the Sahel influences the behavior of the national marketed surplus. Thus, during good years, a higher proportion of total production reaches the market, while during bad years, total marketed surplus tends to drop sharply. Although the level of production influences the inter-annual variability of marketed surplus, the marketing strategies of producers determines the seasonal distribution of marketed surplus within years.

The majority of producers with no cash crops tend to concentrate their cereal sales during the harvest season when prices are low. For example, Dioné (1989) found that farmers made 16 percent of their grain sales at harvest in the cash-crop- producing zones

at harvest against 58 percent for farmers in regions where cereals are the only available crop. Cebron and Sanogo (1991) found that farmers made 96 percent of their grain sales at harvest in the region of Segou against 76 percent for farmers in the Koro zone (region of Mopti) during the agricultural season of 1988-89. These findings indicate that the proportion of grains sold at harvest increases as one moves from the most productive cash crop zones to the less productive monocereal zones.

The average per capita marketed surplus varies from 7 kg to 71 kg depending on the agricultural zone and on the marketing strategies of producers, which reflect their cash needs. According to Cebron and Sanogo, in the absence of a cash crop, the obligation for farmers to pay back their debts explains 80 percent of the early sales. In contrast, farmers with cash crops store most of their cereals at harvest and spread sales over the season. However, this pattern of the marketed surplus has been changing recently. Indeed, delays in payment for cotton, the main cash crop, have forced producers from the region of Sikasso to sell more during harvest period in recent years.

This change in marketing strategy implies that marketed surplus peaks during harvest time and declines progressively over the months. As a consequence, the storage function has been shifting from producers to traders, and the general farm-gate price level at harvest may have declined. However, with a supply elasticity of 0.006 to 0.565 for the major coarse grains (Sijm, 1992), a decline in producer price should have a minor impact on marketed surplus in the short run. Only the ability of cereal producers to accumulate productive capital would be impaired in the long run.

3.1.1.2. Commercial imports and food aid

Rice constitutes the bulk of cereals imports in Mali. Since the drought years of 1971-73, imports have become an important source of cereal supply. Cereal imports

comprise commercial imports and food aid. The gap between domestic consumption and production and the variation of domestic production determine to a large extent the import needs of the country in any single year. Between 1978-79 and 1988-89, the average per capita domestic production (total domestic consumption requirements/total domestic production) was 147 kg. Average per capita consumption stood at 169 kg. This gap was filled by cereal imports, which contributed on average for 13 percent of total consumption. During the same period, total imports averaged 159,000 tons per year, with food aid contributing for 70,000 tons or 44 percent of the total.

Total cereal imports have been volatile between 1978-79 and 1988-89. This volatility reflects the fluctuations of domestic production and instability in food imports policy. For example, during the drought year of 1984-85, domestic production was 1 million tons and cereal imports reached the record level of 404,000 tons. Food aid contributed for 237,728 tons, or 59 percent of total cereal imports. In contrast, during the good year of 1988-89, domestic production rose to 2 million tons and imports were limited to 35,000 tons. Thus, cereals import policy aims at offsetting the instability of domestic production. The objective is to stabilize domestic consumption around the official standard of food needs per capita of 167 kg.

Cereals supply in Mali confronts severe structural problems. First, cereal production comes from a multitude of smallholders whose response to market incentives is limited due to severe resource and technological constraints. Second, the bulk of production comes from the Sahel, which is more vulnerable to climatic variations. This translates into wide variations of marketed surplus from year to year. Third, the country must use imports and food aid to insulate domestic consumption from the vagaries of rainfall that affect production.

3.1.2. Cereals demand

Cereals are the main staple food in Mali. The main cereals consumed are millet, sorghum, maize, and rice. These grains supply 70 percent of the calories of urban diet and 80 percent of the calories of rural diet (Badiane et al., 1992, 5). The structure of cereal consumption shows a growing demand fueled by a rapidly growing population and a big share of consumers' expenditure devoted to cereals.

3.1.2.1. Trends in cereals consumption

Population and income growth drives cereals consumption in Mali. During the 1980's, the population grew at an annual rate of 2 percent and was estimated at 8 million in 1987 (World bank, 1989). At the same time, GNP per capita grew at less than 1 percent and stood at $210 in 1987. For the 1990's, the population is expected to grow at an annual rate of 3 percent and will reach 11 million in the year 2000. In the absence of income growth, cereals demand will grow at 3 percent per year in line with population growth in the 1990's.

According to the household consumption survey of 1988, the per capita consumption of major cereals in Bamako, the major urban center, was 144 kg in 1988-89. This total was composed of 64 kg of rice, 40 kg of sorghum, 24 kg of millet, 35 kg of maize, 1 kg of fonio and 1 kg of wheat products (Badiane et al., 1992). The data show the importance of rice, sorghum, and maize in the urban diet. However, production data reveal that sorghum and maize production is unstable due the variability of harvested area in these zones.

Although cereals consumption was found to be adequate in rural areas, it fell short of nutritional requirements in urban centers (Baidiane et al., 1992). The bulk of locally grown cereals are consumed in the rural areas while urban consumers prefer rice, sorghum, and maize to drought resistant millet. However, drought resistant millet constitutes the bulk

of total cereals production.

3.1.2.2. Patterns of household expenditures

The only sources available on household expenditures in Mali are two household consumption surveys carried out by the statistical bureau of the Ministry of Planning in 1985 and in 1988. Evidence from the survey of 1988 as reported by Badiane et al. (1992, 12), indicates that urban households spent on average 51 percent of their income on food in 1988-89. This percentage varied from 47 percent in Koulikoro to 71 percent in Tombouctou. The high proportion of income spent on food indicates that cereals constitute indeed a wage good in Mali.

Of the total food expenditures, cereals accounted for 48 percent on average. The composition of cereals expenditures indicates that rice and wheat products share ranged from 63 percent in Segou to 74 percent in Bamako, while their share in total consumption ranged from 10 percent in Koulikoro to 42 percent in Gao (see table 3.5). These data indicate that rice and wheat products prices have a greater influence on urban consumers real income than do coarse grain prices.

Table 3.5   Share of rice and wheat products in total consumption and expenditure

	Bamako	Koulikoro	Segou	Gao
Share in: (Percentage)				
Consumption:	45	10	20	42
Expenditure:	74	71	63	71

Source: DNSI - Household consumption survey: 1988-89

The responsiveness of urban consumers to changes in prices and income has been analyzed by Rogers and Lowdermilk in 1988. They found an expenditure elasticity (a proxy for income elasticity) of 0.593 for rice and 0.514 for millet and sorghum. These elasticities differ little in value, indicating that a rise in expenditure or income results in a sharp increase in the quantities consumed of rice and millet/sorghum at the same rate. Moreover, the household consumption survey indicates that the proportions of rice and coarse grains do not vary by income class, i.e., the mix of foods does not change much as income rises.

Rogers and Lowdermilk found a price elasticity of -0.8 for rice and -0.7 for millet and sorghum. The cross-price elasticity between rice and millet/sorghum is -0.944, indicating that an increase in the price of rice leads not only to a reduction in rice consumption but also to less purchase of millet/sorghum. Moreover, the positive cross-price elasticity between coarse grains and rice suggests that an increase in coarse grains price leads to an increase in rice consumption.

The patterns of household expenditures also show that urban cereals consumption is responsive to prices and income changes. Rice and wheat products price changes have a much greater impact on consumers welfare than coarse grains prices. However, overall cereal demand is price inelastic. With an expenditure elasticity of 0.6, a rising income level will lead to a sharp increase in overall cereals demand. The high share of rice and wheat products in total food expenditures indicates that a rising income level will lead to increased imports.

The analysis of the structure of cereal supply shows that domestic supply of cereals comes from a multitude of dispersed small farm households which sell a small fraction of total production. Therefore, unit marketing cost is higher. The bulk of domestic marketed surplus comes from the Sahel region, where rainfall is unstable. As a result, investment in

marketing infrastructure and operations are risky for traders.

Cereals exports constitute the second source of cereals demand in the country. During the 1960's, the country was a net exporter, with the Ivory Coast, Senegal, Mauritania as the main export markets. Millet constitutes the bulk of cereals exports to Senegal, Mauritania, and the Ivory Coast. However, the Senegalese and the Mauritanian prefer the drought resistant varieties of millet grown mainly in the Sahel where the instability of rainfall affects the stability of makes marketed. In contrast, consumers in the Ivory Coast prefer the traditional variety of millet grown in the region of Sikasso, where millet competes with cotton. Thus, cereals exports are likely to be unstable due the instability of domestic production. This increases the risk of investment in cereals export operations.

3.2. Organization of the marketing system

Two main participants intervene in cereals marketing in Mali: the private sector and the public sector (see figure 3.1). The private sector assures the transfer of cereals from farmers to consumers and carries out most of the export and import transactions. The public sector manages the national food security stock (NSS), the market information system and participates directly in rice marketing through the Office du Niger (O.N.).

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Figure 3.1   **Organization of the Cereals Subsector**
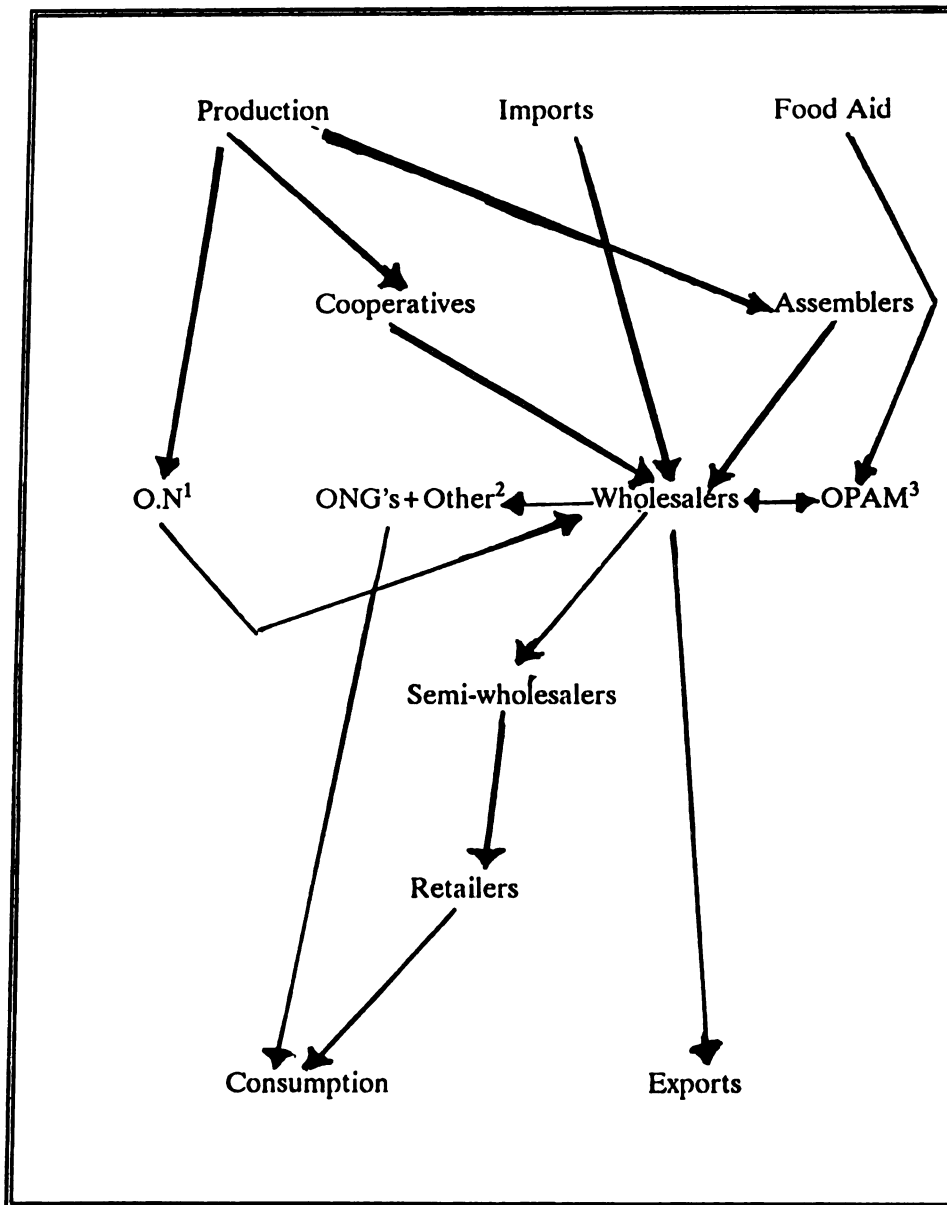
1. O.N refers to Office du Niger
2. Other refers to public institutions such as the army
3. OPAM refers to Office des Produits Agricoles du Mali

3.2.1. The private sector

The private sector comprises traders and cooperatives (see figure 3.1). There are two types of cooperatives in Mali: farmers' cooperatives and consumers' cooperatives. Farmers' cooperatives have been heavily involved in cereals assembly, storage, and selling activities since 1987. Consumers' cooperatives, which were active in cereals distribution before the market reforms, are no longer players in the cereals market.

3.2.1.1. Private traders

Private traders constitute the backbone of the marketing system. They assure the coordination of domestic cereals production and consumption, the importation of commercial imports, and the distribution of imported cereals and food aid sold in the domestic market. Although there is no study available on the total number of traders in Mali, a national estimate carried out by the FAO in 1992 found a total of 2,038 traders for the whole country (FAO, 1992, 28). These data were derived from estimates made by OPAM field agents. The FAO study identified four categories of traders: wholesalers, semi-wholesalers, retailers, and assemblers. This classification is generally accepted by most marketing researchers in Mali.

Table 3.6   **Number of Actors by Categories**

	Wholesalers	Semi-wholesalers	Assemblers	Retailers
Kayes	13	20	85	11
Koulikoro	17	38	128	57
Sikasso	34	25	87	308
Segou	46	66	124	213
Mopti	22	50	164	20
Tombouctou	1	15	4	-
Gao	9	22	220	7
Bamako	30	63	129	-
Total:	172	299	951	616

Source: FAO: Développement du marché céréalier, 1992

3.2.1.1.1. Assemblers

The FAO data identified 616 assemblers in 1992. They made up 30 percent of the total number of traders. The regions of Sikasso and Segou, with most of the marketed surplus, had 512 assemblers, or 83 percent of the national total. In contrast, the deficit regions of Kayes, Gao, and Tombouctou had only 18 assemblers, or 3 percent of the total. Although these estimates may not be accurate, they do reflect the distribution of the marketed surplus in the country.

Assemblers reside in producing zones and collect cereals from producers at the farm level (see figure 3.1) in villages or in rural markets for resale or they may work for a wholesaler who finances their activities. The number of assemblers in a rural market during a given day varies between 10 and 20, with an average of less than 1 ton of grain collected by assembler (Dembélé et al., 1986). Assemblers constitute the first handlers of grain in the marketing system and the first stage in the cereals subsector.

Assemblers may be independent or they may work for a wholesalers. Independent assemblers are usually farmers who become grain traders. They may live in villages where they buy grains from fellow farmers and in adjacent rural markets or in rural towns. The independent assemblers may sell in rural markets or in nearby rural towns. When supplies are short in rural areas, independent assemblers buy from wholesalers in rural towns and sell back in villages and in rural markets.

Assemblers who work for a wholesaler live either in villages or in rural towns. When they live in villages, they are farmer-assemblers who receive money from urban wholesalers to buy grain on their behalf. The farmer-assemblers do not go to rural markets, but they buy grains from other farmers with whom they live in the same village. They constitute a convenient and accessible market for producers who do not go to weekly rural markets or need cash when these markets are not held. The farmer-assemblers do not sell back grain to farmers when supplies are short.

Assemblers who work for a wholesaler and live in rural towns typically buy grain in more than four rural markets located in a boundary of 60 kilometers of their town of residency (Dembélé et al., 1986). Independent assemblers assure the transportation and storage of the grain they assemble. However, the period of storage rarely exceeds one week. Because they are self-financed, independent assemblers bear the risk of price fluctuations. In contrast, assemblers who work for a wholesaler do not assure the transportation or the storage of the grain. They support no price risk and are paid the difference between the buying wholesale price in the rural town of reference and the rural market price less transportation and handling costs, which are paid by the wholesaler.

3.2.1.1.2 Wholesalers

Wholesalers are distinguished from other types of traders by the scale of their operations. Mehta found in 1985-86, the average annual volume handled by urban wholesalers in Koutiala and Sikasso varied between 752 and 1091 tons of cereals (Mehta, 1989). These wholesalers will be referred here to as wholesale assemblers. Urban wholesalers from Mopti and Bamako transacted between 1736 and 2613 tons annually (Mehta, 1989, 67). According to the FAO report, there were 172 wholesalers in Mali in 1992, representing 8 percent of the total population of traders.

The distribution of wholesalers revealed that the regions of Segou and Sikasso had 47 percent of the total population, against 13 percent in the deficit regions of Kayes, Tombouctou, and Gao. Bamako, the biggest consumption urban center in the country, had 30 wholesalers or 17 percent of the total population. The region of Mopti, which is a net cereals importer, had 22 wholesalers, while the region of Koulikoro which is nearly self-sufficient, had 17 wholesalers. Again, the distribution of wholesalers accords with the distribution of marketed surplus and the population in Mali among regions.

The number of wholesalers in individual cities varied from 5 to 18 according to the CESA-MSU field surveys of 1988 carried out in four cities. These surveys found 11 wholesale assemblers in Koutiala, 5 in Sikasso, 18 wholesalers in Bamako, and 6 in Mopti for a total of 33 wholesalers in four cities. These numbers suggest that the FAO estimate may be inaccurate or that the number of wholesalers may have increased between 1988 and 1992.

Table 3.7 Distribution of wholesalers by city

City	Wholesalers
Koutiala	11
Sikasso	5
Mopti	6
Bamako	18
Total:	33

Source: CESA-MSU field surveys: 1988

The CESA-MSU survey of 1985 classified wholesalers according to their degree of specialization in the cereals trade and their period of entry in the trade. According to this classification, 92 percent of the wholesalers declared themselves to trade in cereals only, while 8 percent were non-specialized in the four cities. Two periods of entry in cereal trade were distinguished by the CESA-MSU survey: before trade liberalization in 1981 and after liberalization. According to this criteria, 69 percent of the wholesalers entered the cereal trade before liberalization and 31 percent entered after liberalization.

Wholesalers constitute the engine of the marketing system. They perform the functions of aggregating supplies from assemblers, transportation, storage, and financing. However, the functions performed depend on where the wholesaler resides. Wholesale assemblers finance most of the assembly, transportation and delivery to wholesalers in urban centers. Urban wholesalers perform usually the storage function and may pre-finance wholesale assemblers when urban demand is high.

3.2.1.1.3. Semi-wholesalers

Semi-wholesalers are found in producing zones and urban centers. They handled an average annual volume that varied between 186 and 437 tons in 1985-86 compared to an average volume of 1736 to 2613 tons for urban wholesalers (Mehta, 1989, 67). The FAO study identified 299 semi-wholesalers in Mali in 1992. The majority of these semi-wholesalers were operating in Bamako and the regions of Segou, Mopti, Koulikro, and Sikasso. Semi-wholesalers represented 15 percent of the whole population of cereals traders.

The CESA-MSU field surveys of 1988 found 75 semi-wholesalers in the cities of Koutiala, Sikasso, Mopti, and Bamako. Bamako and Mopti, the major consumption centers, had 63 percent of the total population. The surveys also found that 86 percent of the semi-wholesalers were specialized in cereals trade, while 57 percent entered the trade before liberalization.

Semi-wholesalers perform mainly the function of distribution. They purchase from wholesalers and sell to retailers and consumers. Semi-wholesalers may integrate vertically the functions of assembly, wholesaling, and retailing. However, semi-wholesalers usually get their supplies from independent assemblers and wholesale assemblers during harvest time and sell to retailers and consumers. Later in the year, they start to take supplies from urban wholesalers.

3.2.1.1.4. Retailers

Retailers are more numerous in urban centers. They handle on average 200 kg of cereals per week (Dembélé et al., 1986). The FAO study reported a total of 951 retailers for the whole country. They represented 47 percent of the population of traders. The distribution of retailers shows that Gao, Mopti, and Bamako had 55 percent of the total

population. Tombouctou and Kayes had few retailers compared to other regions.

Retailers link consumers and the rest of the marketing system. They get their supplies from semi-wholesalers and wholesalers and sell directly to consumers. Retailers may sell by bags of 100 kgs or less than a kilogram. They serve mainly the needs of poor households who purchase less than a bag of 100 kgs and who go daily to the market to get their supplies.

Women are more active in retailing than men in many cities. When the retailer is a women, she tends to use traditional weighing equipment instead of the standard kilogram. The majority of women in the retailing business may be explained by the labor-intensive nature of retailing and the low opportunity cost of women's time. Indeed, women have less access to education and to productive assets than men in most developing countries.

3.2.2. Farmers' cooperatives

Farmers' cooperatives in Mali have a long history. Since colonial times, the French organized the peasantry into cooperatives to hold food security stocks in the villages to prevent famine. After independence in 1960, the new government opted for a collectivisation of agriculture, and cooperatives were created in each village in an authoritarian and paternalistic fashion. These cooperatives were charged with the assembly of grain and its transfer to OPAM warehouses at fixed official prices.

Although the paternalistic approach to cooperative formation continued after the change in government in 1968 that ended the socialist approach to agricultural development, the new government tried to promote farmers' cooperatives along voluntary lines. However, the government insisted that there could be only one cooperative per village. In the cotton-producing zones, farmers' cooperatives were to take over progressively the distribution of inputs and credit, the collection of loans from members, and the primary marketing of

cotton through adequate training of village leadership.

The number of farmers' cooperatives went from 1070 in 1987 to 2447 in 1990 (Coulter and Tyler, 1993). The increase in the number of cooperatives reflected the policy changes of 1987/1988 which led to a reduced role for the state and a greater involvement of the private sector in grain marketing. Indeed, during that year, OPAM stopped its price stabilization activities and the PRMC made available annual marketing credit to farmers' cooperatives. The basic assumption was that the success of farmers' cooperatives in the management of farm credit, inputs distribution, and primary marketing of cotton in the CMDT zone could be successfully replicated in grain marketing.

Table: 3.8   **Volume of Cereals Transactions of Farmers' cooperatives (Tons)**

Years	Purchases	Sales	Carry-over Stocks
1988/89	167	38.5	128.5
1989/90	76.7	160.9	44.3

Source: Cebron and Sanogo (1991)

The primary objective of farmers' cooperatives is to support the farm price at harvest by buying and storing grain at harvest for sale when price rises later in the season. Thus, their main functions are grain assembly, storage, and wholesaling. Data from table 3.8 reveal that the cooperatives bought 167 tons of cereals in 1988/89 and stored 128.5 tons to the next harvest. The high level of stocks and the low sale figure are the result of the record harvest of more than 2 million tons of cereals in 1988/89. Cooperatives from the regions of Segou and Mopti accounted for 64 percent of the total purchases and 75 percent of the stocks. These percentages are in line with the distribution of cereals production in the

country.

During 1989/90, the cooperatives bought 76.7 tons, sold 160.9 tons and carried over 44.3 tons. The high sale figure and the low level of stocks in 1989/90 reflect the average harvest during that year. The distribution of cereals transactions among regions reveals that cooperatives from Segou and Mopti contributed for 74 percent of total purchases, 72 percent of total sales and 88 percent of total stocks.

The ability of farmers' cooperatives to reduce the structural constraint of grain assembly requires the development of their marketing skills. Cebron and Sanogo report that most of these cooperatives rely on rural assemblers for their grain purchases when their members do not have adequate marketable surplus. In the deficit zones, the cooperatives import most of their grain from surplus zones and buy directly from wholesalers. For the sale of their grain, cooperatives sell to their members in the deficit zones. Farmers' cooperatives in the surplus zones face the problem of finding buyers at the right time. Indeed, the high stock level of farmers' cooperatives in these zones may well reflect their lack of access to the main marketing channels. Thus, the main obstacle to the development of the cooperatives may well be their inability to establish stable trading relationships with private traders.

There are two main constraints to the establishment of stable trading relationships between farmers' cooperatives and private traders. First, the cooperatives must be ready to sell on credit to traders. But, the cost of assessing the creditworthiness of traders, monitoring, and collecting loans may be too high for farmers. Second, field discussion with traders revealed that they do not want to deal with farmers' cooperatives. Traders argue that most of these cooperatives do not see themselves as business units and tend to impose prices. Thus, most traders fear that the development of the cooperatives will lead to the old

practice of producer price fixing under pressure from the government.

3.2.3. The public sector

The public sector comprises OPAM and the Office du Niger (ON). These two public agencies play different roles in the marketing system. OPAM manages a national food security, food aid, and a market information system. The Office du Niger manages the largest irrigation scheme in the country and engages in rice marketing.

3.2.3.1. Evolution of OPAM's role

During the first phase of the market reforms, which covered the period of 1981 to 1987, OPAM's official monopoly over coarse grains marketing was lifted. The reforms sought to restructure OPAM and to improve its operational efficiency. Producer prices were to be gradually increased and consumers were to be protected from the impact of these price increases by a subsidy which would be covered by PRMC. Indeed, the donors agreed to provide 250,000 tons of food aid to be sold to cover OPAM's deficit and to finance other aspects of the market reforms over a period of five years. Consequently, OPAM was charged with the stabilization of producer and consumer prices through the operation of a buffer stock. In addition, OPAM managed a national security stock, food aid, and supplied the deficit zones.

To improve operational efficiency, OPAM's personnel was reduced from 1098 workers in 1981 to 704 in 1987. Transportation capacity went from 580 tons in 1981 to 360 tons in 1987 through the sale of some trucks to the private sector. For its transportation needs, OPAM has to contract with private transporters instead of maintaining its own fleet of trucks. The restructuring process went along with an intense training effort of OPAM's personnel.

Between 1981 and 1985, OPAM was able to intervene effectively in the cereals market to support the producer price and to subsidize consumers. The resources generated through the sale of food aid were sufficient to finance the subsidy, and improved operational efficiency kept OPAM's deficit at low levels. However, this success resulted mainly from the general cereals production deficit the country experienced during that period which led to increased food aid shipments and to market prices that were usually above the official farm-level support price (Coulter and Tyler, 1993).

Although the proceeds from food aid sales allowed OPAM to play its stabilization role during the deficit years, this strategy reached its limits when the country started to experience bumper crops in 1985-86. Indeed, OPAM accumulated important stocks with the bumper crop of 1985-86 when it was forced to defend producer price. During that year, market prices stayed below official prices at the consumer level, and OPAM had to carry a stock of 70,000 tons into the next crop year. However, the country experienced a second bumper crop in 1986-87, which exhausted the funding capacity of the PRMC. OPAM was forced to suspend purchases. As a consequence, producer prices fell below their previous level of 1985-86 and OPAM was left with a stock of 142,000 tons.

The inability to use the proceeds from food aid sales to support producer prices during the bumper crop years led to the reappraisal of the market reforms in 1988. Indeed, the cost effectiveness and the ability of the government to defend the producer price through the management of a buffer stock was questioned. At the same time, researchers were finding that it was rainfall, and not price, which was the main determinant of cereals production.

Moreover, empirical evidence from the CESA-MSU research efforts indicated that only a small percentage of well-off producers could benefit from a producer price support program while the majority of producers who were net buyers, would be hurt (Dioné, 1989).

The empirical evidence gathered by researchers led to a fundamental change in the basic assumptions of the first phase of the market reforms. Indeed, policy makers had assumed that most producers were net sellers and that price was a major determinant of production levels until research results indicated that rainfall, technology, and institutional support services such as extension were also important factors that determine cereals production. Consequently, the second phase of the PRMC, which covered the period of 1986-1990, adopted a new strategy.

The new strategy called for an improvement of the private marketing system through the provision of public supporting services. The idea of a minimum guaranteed producer price supported through the operation of a buffer stock was abandoned. Instead, the producer price was to be supported through indirect measures such as market information, credit programs, and cereals export assistance to traders. To finance these new instruments, the donors agreed to provide 150,000 tons of food aid for the second phase of the market reforms. Thus, the new strategy relied on the sale of food aid to finance the provision of market facilitating services that are believed to lead to an efficient and dynamic private marketing system.

With its emphasis on the development of the private sector, the new strategy demanded a more efficient OPAM with a reduced role. OPAM was now charged with the management of a national security stock (NSS) and food aid, the sale of cereals in the remote areas where the private traders were assumed deficient, and the provision of improved market information and training services to the private sector.

The new role of OPAM led to further reduction in personnel and the number of trucks operated by OPAM. Indeed, OPAM's personnel went from 740 in 1987 to 297 in 1990 while transportation capacity went from 360 tons to 90 tons during the same period. At the same time, annual total operating costs went from 4.6 billion CFA in 1987 to 588 million CFA in 1990 (OPAM, 1993).

Since 1988, OPAM has been subject to a performance contract known as "contrat-plan", which is reviewed annually by the PRMC. Under the contrat-plan, OPAM is no less than a service provider to the PRMC. Thus, the management of the NSS and food aid, the sale of cereals in the remote areas, and the provision of market information and training services are subject to strict guidelines and OPAM must submit annual operating budgets for the provision of these services to the PRMC for approval.

3.2.3.1.1. Management of the national food security stock (NFSS) and food aid

The total size of the NSS is 58,500 tons and consists mainly of millet and sorghum. This level of the NSS is believed to be sufficient to cover the country's requirements in the event of poor harvest before the arrival of food aid and commercial imports. The management of the NSS and food aid is subject to strict guidelines spelled out in the contrat-plan. These guidelines seek to improve the operational efficiency of OPAM and to avoid the disruption of the cereals market by the management of the NSS and food aid.

The guidelines relative to the NSS concern its constitution and the modalities of its release. First, the NSS comprises millet and sorghum and is constituted through local procurement during bumper-crop years and food aid or imports when the country experiences a poor harvest. The methods for local procurement have evolved over time to improve the efficiency of the private marketing system. Between 1982 and 1988, OPAM contracted directly with few big traders for local procurement to replenish the NSS.

The direct contracting method was criticized on two grounds. First, it was found that direct contracting tended to reinforce the market power of a few big traders and to undercut the efforts of the PRMC to increase competition in the marketing system. Second, this method created some rents for both OPAM's personnel and the big traders, was the source of corruption, and tended to increase the acquisition cost of the NSS.

Since 1988, local procurement has been made through open tender. The system is open to all traders including farmers' cooperatives. The objective is to increase the number of bidders and to train traders in contractual marketing where quality specification and delivery schedule must be highly respected. Each participant is required to submit a sealed bid at a cost of 10,000 CFAF and 5 percent of the value of the bid as a performance bond. Although an open tender system has been established, the minimum size of more than 100 tons is believed to be out of reach of most traders. However, OPAM has resisted pressures from both PRMC and traders to reduce the minimum size in order to keep administrative cost of the system at a manageable level.

Quality control during the constitution of the NSS is carried out by the personnel of the stock protection service of OPAM. This personnel has received adequate training and the result has been higher and strict quality standards imposed on traders when they deliver grain to OPAM. These standards require no more than 4 percent of impurities and 7 percent of undersized grains for millet and 4 percent impurities for sorghum. The maintenance of the quality of stored grain is achieved through the application of good store hygiene, the regular rotation of the stock, and the use of chemicals and well-designed storage facilities. Although these new techniques have reduced storage losses and preserved the quality of the grain, they appear to be too costly and cannot be transferred to the private sector without subsidies (Coulter and Tyler, 1993).

The guidelines contained in the contrat-plan authorize two methods for the release of cereals from the NSS: technical rotation of the NSS and food emergency releases during crises. The technical rotation requires that OPAM sell each year one third of the NSS and to replace it with new grain. The assumption is that millet and sorghum deteriorate after three years in storage. To release stocks from the NSS during food crises, the PRMC relies on reports provided by a donor financed famine early warning system known as SAP (Système d'Alerte Precoce). Because SAP is located within the Ministry of Interior and relies on data provided by local administrators and politicians, its estimates of the number of people at risk and the level of food aid required have become controversial over the years.

Because of the political pressure to which SAP reports are subject and the desire of PRMC to avoid the disruption of the cereals market by free distribution of food aid, the release of cereals from the NSS for food emergency purposes has become controversial between the government and donors. For example, in 1990-91, the government requested the free distribution of 100,000 tons of cereals. This request was reduced to 12,000 tons by the PRMC after a complicated process of discussion between the government and the donors, with SAP reports playing a minor role. However, the move from technical criteria to political considerations for the release of cereals from the NSS for emergency purposes threatens to undermine the good working relationships between the government and the donors under the umbrella of PRMC.

Food aid includes two components: a structural component and a variable component. The level of the first component depends on the financial needs of the PRMC during any given period. In contrast, the level of the variable component depends on the size of the food deficit. The NSS was initially funded by the structural component.

Currently, the structural component of food aid finances the operating cost of the NSS and other PRMC-supported activities such as the SIM, while the variable component funds the constitution of released stocks for emergency purposes.

The structural component of food aid is made up of rice and wheat products. It is sold through an open tender system and the proceeds are used to finance the market reform process and the services provided by OPAM under the terms of the contrat-plan. The variable component of food aid is distributed as grants to households in the deficit zones who lack sufficient purchasing power. However, a certain percentage is usually sold to cover the costs of distribution and handling incurred by OPAM and other agencies, such as the Ministry of Interior.

The management of the NSS and food aid greatly affects the cereals market. Although the replenishment of the NSS creates an additional and predictable demand for traders each year, the tendency to distribute that demand across all agricultural zones to support the producer price creates unnecessary localized price pressure. Instead of moving cereals from the surplus zones to the deficit ones, OPAM tries to give quotas to each zone for the replenishment of the NSS under political pressure. These quotas inflate prices in the deficit zones and create pressure for food aid distribution soon after OPAM finishes its operations. As a consequence, the NSS is replenished at higher price than would be the case if the cereals were bought at low price in the surplus zones and shipped to the warehouses located in the deficit zones.

The sale of food aid also disturbs the cereals market in three ways. First, most of the food aid is made of rice. This rice is sold during harvest and competes with local rice production (Dembélé, 1990). Second, the volume of food aid available for sale and the precise moment of sale are unknown to traders. This creates undue uncertainty for traders,

specifically in the deficit zones. Third, food aid and cereals released from the NSS are sold in the deficit zones at below cost and market prices.

Although the government has authorized OPAM to sell at market prices in the deficit zones, administrative constraints have prevented the change to market prices. Indeed, OPAM's sale price is fixed by administrative decision in Bamako by the general director of OPAM and can be changed only by administrative decision of the general director in Bamako. This rigidity prevents OPAM's regional officers from adjusting quickly to changes in supply and demand conditions. As a result, OPAM has been unable to sell important quantities in the deficit zones over the last five years. Despite these negative impacts, the management of the NSS and food aid has had some positive influence on the marketing system. First, the open-tender system has attracted many merchants to the cereals trade and has trained many traders in an open-tender system (Coulter and Tyler, 1992). Second, the quality standards required for the replenishment of the NSS are close to the quality standards of 2 percent used in international transactions. Thus, successful bidders with OPAM acquire the skills to trade in international markets. The last contribution of the management of the NSS and food aid has been the development of quality control and stock management skills within OPAM that can be transferred to the private sector to promote cereals exports.

3.2.3.1.2. Provision of supporting public services

Although the concept of a minimum guaranteed producer price was abandoned in 1988, the government maintained the notion of stable renumerative prices. Stable renumerative prices were defined as those prices that cover production costs from year to year. These prices were seen as necessary for the adoption of the technologies generated by the national agricultural research services. But, with the new strategy that emphasizes

an increased role for the private sector in grain marketing, the government was doubtful of the ability of the market to coordinate supply and demand at a price at harvest compatible with producers' resource cost.

The limitation of government resources and donors resistance to finance OPAM's losses that result from the stabilization program implied that the producer price was to be determined by market forces. However, available evidence from different studies indicates that gains in operational efficiency of the marketing system could be achieved through the availability and accessibility to improved market information and credit to all actors. Such gains could result in higher producer prices and low consumer prices through increased competition. Thus, the provision of these services is seen not only as more cost effective than the management of a support program, but also in line with the financial capabilities of the PRMC.

The provision of improved market information was needed, as farmers were found to be particularly ill-informed about cereals prices in urban centers and nearby towns and could not bargain effectively with traders. Traders also needed multi-market information to monitor and counter-check prices reported by their buying or selling agents in other regions. Meanwhile, price series were also needed to evaluate the impact of the market reforms on both producers and consumers and to assess the effectiveness of the marketing system over time. Thus, to improve the transparency and competitiveness of the marketing system, OPAM was charged with the creation and the management of a market information system (SIM) in 1988.

OPAM set up the SIM in mid 1988 and designed it to serve the information needs of two types of clients: the private sector composed of farmers, traders and consumers; and the public sector, made up of researchers and policy makers. Initially, given its limitations

of financial and human resources, the SIM focused on the weekly collection and diffusion of cereals prices. However, the designers of the SIM took into consideration the evolution of users' information needs. Thus, during the initial years, the designers of the SIM planned for the development of human resources and the gradual collection and diffusion of different types of information relevant to the understanding of the cereals marketing system.

Today, the SIM generates two types of products: a market news bulletin for the private sector and a policy analysis bulletin for policy makers and researchers. The market news covers producer and consumer prices, the volume of transactions in major trading cities, and the variation of commercial stocks in major cities. The market news bulletin is broadcast weekly on the national radio and television stations. The policy analysis bulletin deals with the major policy decisions as they affect the evolution of cereals prices and grain marketing for a period of six months. It provides price series and grain transactions data for the needs of researchers. Beginning in 1994, the SIM also began publishing more frequent, short policy bulletins to follow the impact of the CFAF devaluation on cereals markets.

The first evaluation of the market information system was carried out in 1989 (Egg, 1989). It was found that the market news bulletin was positively affecting the efficiency of the marketing system through the reduction of marketing margins (Coulter and Tyler, 1993). Furthermore, empirical evidence from different informal field investigations revealed that the SIM has improved the bargaining power of producers in the countryside, as they are more informed about cereals prices in major consuming centers. Meanwhile, the policy analysis bulletin has become a force in the discussion and direction of the ongoing cereals market reforms (Dembélé and Staatz, 1989).

Although OPAM was successful in setting up the SIM, the credit program it set up

failed after few years. The credit program started in 1988 and had two components. The first component called for OPAM to provide guarantees to the central bank for the credit extended to traders for cereals marketing. Indeed, before the reforms of the banking laws of the West African Monetary Union (UMOA), traders were not eligible for this line of credit, called "agricultural marketing credit". Only parastatals could access this line of credit under the guarantees provided by the state. With the changes in OPAM's role in 1988, the central bank accepted, under pressure from the PRMC, to make traders eligible for the "agricultural marketing credit" if OPAM were the guarantor.

The guarantees provided by OPAM placed heavy burden on the PRMC. Indeed, as guarantor, OPAM has to support all the risk of the "agricultural marketing credit". Thus, when traders failed to repay their credit, OPAM had to pay the bank and to seize the cereals stocks of the defaulters. However, by seizing these stocks, OPAM would be back in the marketing business, and this was contrary to its new mandate. To minimize the default risk, OPAM was given the authority to determine the credit-worthiness of traders, to supervise the operations of eligible traders, and to enforce modern storage practices. When traders applied for the "agricultural marketing credit", OPAM required them to provide the balance sheets of the last three years of operations and a detailed statement of provisional income and expenses for the coming year. These requirements excluded many traders from this line of credit, and only three big traders were able to access the "agricultural marketing credit" during its three years of operations (Coulter and Tyler, 1993).

The second component of the credit program was designed to overcome the shortcomings of the "agricultural marketing credit" system. It was open to all traders, and the local banks were responsible for the determination of the creditworthiness of applicants. The objective of the second component of the credit program was to train traders in

establishing balance sheets over time to make them eligible for the "agricultural marketing credit". With regard to the second component, OPAM was to rent its storage facilities to eligible traders, and to provide modern stock treatment and management services for a fee.

The first component of the credit program, failed after three years of operations as some traders failed to repay on time their credit and the PRMC had to bail out OPAM. The second component of the program stopped in 1992, as both the local banks and the PRMC tried to shift all the risk to traders by strengthening the eligibility criteria. The failure of the credit program poses the issue of extending credit to traders at harvest in order to expand cereals demand and to raise the producer price. Indeed, through the creation of a strong demand for storage at harvest, such programs can raise producer prices. However, without export possibilities or industrial demand, prices will be depressed when the stored grain has to be sold back in the market.

The volatility of cereals markets in Mali implies that storage activities are very risky and traders may not be able to bear the risk attached to such credit programs. Traders may need access to credit to increase their working capital, but they may not be ready to invest in stocks given the current organizational structure of the marketing system.

3.2.3.2. The role of Office du Niger (ON)

The Office du Niger was created by the French before independence to manage the large scale irrigation scheme set up on the Niger river in Mali. The objective was to provide the French colonies with adequate rice supplies. After independence in 1960, the Office du Niger was strengthened and was charged with the provision of extension and credit services to rice farmers, the collection of paddy from farmers at official prices, the milling of the collected paddy and its transfer to OPAM at a predetermined price.

The rice market was liberalized in 1986 and rice farmers were allowed for the first

time to sell their production in the market after deduction for water charges and other input credit. However, the Office du Niger was required to defend a minimum guaranteed producer price of 70 CFAF/kg for paddy. Thus, when the market offered less than 70 CFAF/kg, farmers sold to the Office du Niger in addition to the paddy collected for water and other inputs.

The Office du Niger became a key player in the cereals market when OPAM stopped its direct buying in 1988. As a result, the Office du Niger had to learn the necessary marketing skills to deal with traders. At the same time, the liberalization of the rice market led to the development of private small mills that were more efficient than the large scale milling installations of the Office du Niger (Dembélé, 1990; Diarra, 1994). Additionally, farmers were authorized to pay water charges either in cash or in paddy. Another important factor was that the Office du Niger paid the same price regardless of the quality of paddy, while private millers paid a premium for higher quality grain. These changes undermined the ability of the Office du Niger to secure adequate quantity of high quality paddy to achieve full capacity utilization of its milling facilities.

Although the rice market reforms were gradual, the Office du Niger was caught in the process with three structural constraints. First, because the Office du Niger pays the same price for paddy regardless of quality, farmers use their low quality paddy to pay water charges and other inputs at the official minimum guaranteed price. As a consequence, the yield of paddy milling has dropped at the milling facilities of Office du Niger. Second, the Office du Niger cannot secure an adequate quantity of paddy to achieve full utilization of its facilities, and this has driven up the unit cost of milled rice. Third, the Office du Niger had no prior marketing expertise and must learn how to manage its stocks and to cope with market price variations.

The above constraints drive up the unit cost of milled rice sold by Office du Niger. With 20 percent of the rice market, the prices charged by Office du Niger have become the reference prices of rice importers (Dembélé, 1990). Because of its lack of marketing expertise, the Office du Niger sells 80 percent of its milled rice to five (5) importers. This marketing strategy reinforces the oligopolistic structure of the rice market. However, the emergence of the private mills that sell directly to semi-wholesalers has tended to break down the oligopoly power in recent years (Diarra, 1994). In addition, the Office du Niger has started an open tender system in 1990 under pressure from the PRMC in order to increase competition.

3.3. Structure of the private marketing system

Market structure usually refers to those characteristics that influence the behavior of the market actors, which in return influences the performance of a given subsector. These characteristics include the number of sellers and buyers, the degree of product differentiation, barriers to entry, cost structure, vertical integration, degree of concentration, etc. Generally, a unique structure is assumed and evaluated against some chosen performance criteria such as pricing efficiency or progressiveness. However, the organizational imperatives vary with the performance criteria selected (Handy and Padberg, 1971).

In the Malian cereals subsector, effective coordination of domestic production and consumption, on the one hand, and traders' investment in stocks and in export operations, on the other hand, are considered as the two main performance dimensions of the private marketing system. However, the organizational requirements for the domestic market are different from those of export markets. This section develops a model of the structure of the private cereals marketing system by distinguishing between a substructure suited to the

needs of the domestic market and a second substructure able to meet the requirements of international markets.

3.3.1. The model

The model is derived schematically. Its main structural elements are two distinct substructures: the core and the periphery. The core and the periphery differ by their differential access to formal capital markets, the managerial ability of their members, and the market segments they serve. The core comprises the assemblers, wholesalers, semi-wholesalers, and retailers identified above. The periphery is made of exporters, importers, and some urban wholesalers. The core and the periphery interact at the wholesale level in the domestic market for both exports and imports.

The domestic supply of cereals is characterized by a multitude of small-scale producers who sell in small, fragmented, dispersed quantities. These small and dispersed quantities must be pulled together into units of viable size for shipment to urban markets. Moreover, the lack of a grading system requires that each small quantity must be individually inspected to determine its quality both at the assembly and retail level. The need to pull together many dispersed and small quantities supplied by farmers and the method of visual inspection are labor-intensive and time consuming. Thus, the structure of rural supply and the pattern of consumers' purchases demand labor-intensive marketing methods and a low capital requirement for the domestic market.

The core is willing to expend the needed labor in the domestic market at low returns because most of its members have no access to formal capital markets and lack alternative uses for their labor. Thus, the supply of labor within the core is inelastic and marketing margins can fall to some low level without affecting the number of people engaged in assembly and retailing. However, the fact that the core depends on its own capital, retained

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earnings, and informal capital markets means that it will operate at a much smaller scale compared to the periphery.

The small to moderate scale of firms within the core implies that many of its members are too small to spread the risk of business failure over many activities. This inability to spread risk leads to an emphasis on business survival within the core through flexible marketing arrangements. Indeed, small traders need to adjust daily to local conditions of supply and demand by reducing the length of time during which their limited capital is tied up in cereals. Consequently, forward planning of supplies and sales as management tools are less emphasized. Thus, traders within the core are likely to have less long-term managerial skills.

In contrast to the domestic market, the export and import markets require large scale operations and timely delivery. To enter these markets, a trader needs international trading experience and abilities and constant access to information about the evolution of external market conditions. Thus, both the managerial skills and capital requirements are higher for the international markets than for the domestic markets. Thus, as one moves from assembly to higher stages in the marketing chain, the scale of operation rises and both managerial skills and capital requirement increase.

The periphery, with its access to formal credit markets, provides the needed scale and managerial skills required for export markets and institutional buyers such as OPAM. Indeed, access to formal capital markets requires that the periphery adopt standard business practices such as accounting and forward planning and emphasize maximum returns to investment. However, the supply of capital and managerial skills at this higher level of wholesaling will become very elastic and more sensitive to the variation of marketing margins because traders have alternatives for their capital and managerial skills.

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The attributes by which the core and the periphery are hypothesized to differ are summarized as follows:

(a) Access to formal credit (ACC). ACC is a dummy variable that takes the value of 1 when the trader has listed the banks and the credit program of the PRMC as one of his credit sources and the value of zero when none of these sources is listed. The core is hypothesized to have many fewer traders with access to these sources of credit compared to the periphery.

(b) Managerial ability (ABIL). ABIL takes the value of 1 when a trader has adopted any of the four following management tools: formal written accounting, forward planning of supplies, forward planning of sales, and forward planning of cash flow (credit needs planning). Thus, the values taken by ABIL varies between zero and four. The implicit assumption is that each of the management tool has an equal weight on performance. The core is hypothesized to have fewer traders who have adopted accounting and forward planning practices.

The practice of forward cash planning or credit needs planning by a trader must be emphasized because it indicates that the trader has made the separation between his own personal financial needs and those of his business. Indeed, many traders still do not separate their own finance from the resources of their businesses. The tendency is to confuse sales and net returns. Therefore, many traders end up spending their capital and are unable to pay their suppliers on time. This constitutes a serious problem in Mali and prevents many traders from accumulating adequate capital over time. As result, traders tend to look at gross margin per unit sold instead of evaluating net return to total investment or assets.

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(c) Cereals exports or types of market served (EPO). EPO is a dummy variable that takes the value of 1 when a trader has declared to be engaged in export operations and the value of zero when the trader deals only in the domestic market. The core is hypothesized to have fewer exporters than the periphery.

The study uses the method of cluster analysis to test the hypothesis of the existence of two distinct substructures within the private cereals marketing system.

Romesberg (1990, 2) defines cluster analysis as "a generic name for a variety of mathematical methods, numbering in the hundreds that can be used to find out which objects in a set are similar." He defines a cluster as "a set of one or more objects that we are willing to call similar to each other." Thus, the main objective of cluster analysis is to find similarities among objects in order to develop a typology or classification of these objects. However, researchers also use cluster analysis for hypotheses testing by determining if some classes hypothesized to exist are in fact present in a data set (Aldenderfer and Blashfield, 1986; Romesberg, 1990).

The use of cluster analysis for hypotheses testing involves the computation of similarity or dissimilarity measures, the choice of a clustering method, and the validation of results. Although there exists many ways to compute similarity or dissimilarity measures, this study uses the following squared Euclidean distance formula to compute the dissimilarity measures:

$$D_{ij}^2 = \sum_{k=1}^{3} (X_{ik} - X_{jk})^2$$

where, in the equation, D^2_{ij} is the squared distance between cases i and j, and X_{ik} is the value of the kth variable for the cases i and j.

The study uses the average linkage between group method called UPGMA (unweighted pair-group method using arithmetic averages) for combining clusters. The UPGMA method computes the distance between two clusters by averaging the distances between all pairs of cases where one member of the pair is from each of the clusters. The advantage of the UPGMA method over other methods is that it uses information about all pairs of distance (Norusis, 1993).

The results from the cluster analysis are validated by using external variables, not the variables used to create the clusters. According to Aldenderfer and Blashfield (1986), the use of multivariate analysis of variance of the variables used to generate and to test for the significance of the clusters in applied research is inappropriate statistically.

> Cluster analysis methods, by definition, will separate entities into clusters that have no overlap along the variables being used to create the clusters. Significance tests for differences among the clusters along these variables should always be positive. Since these tests are positive regardless of whether clusters exist in the data or not, the performance of these tests is useless at best and misleading at worst (Aldenderfer and Blashfield, 1986).

Aldenderfer and Balshfield favor the use of external variables or variables not used to generate the clusters because they are powerful in testing directly the results of a cluster analysis against relevant criteria. This study performs a multivariate analysis of variance of external variables to test for differences among the clusters. The data used in the cluster analysis come from a sample of 55 traders and were collected between March and June 1990 under the CESA-MSU-AID food security project. The traders are assembly wholesalers from Koutiala and wholesalers from Bamako and Mopti.

3.3.2. Empirical results

Table 3.9 and 3.10 present the results of the empirical model. To test whether the two clusters differ, an analysis of variance was performed on rented storage capacity (rented) and sales level (sales). The computed F-statistics indicate that the two clusters

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differ significantly at the 1% level for sales and at the 6% level for rented storage capacity.

Thus, the hypothesis that there exists two substructures that compose the private marketing

system, namely the core and the periphery, can be accepted.

Table 3.9   **Analysis of Variance (Groups by Sales and Rented Storage capacity in 1989)**

Source		Sales (tons)				Rented Storage Capacity (tons)		
	D.F	Mean Square	F	F Prob.	D.F	Mean Square	F	F Prob.
Between Groups	23	0.2339	2.55	0.0013	19	0.1345	2.15	0.0635
Within Groups	20	0.0583			16	0.0625		
Total	43				35			

From the sample of 55 traders, the cluster analysis assigned 42 traders to the core

(or 76% of the total sample) and 13 traders to the periphery (or 24% of the total sample).

All traders assigned to the periphery were all from the capital city of Bamako. The

distinguishing characteristics of the members of the periphery are managerial ability,

accessibility to formal credit, and high scale of operations (Table 3.10)

The average on the scale of managerial ability for the periphery is about 3 on a scale

of 4 against 0.6 for the core. This indicates a low level of managerial ability within the

private marketing system as measured by accounting practices, forward planning of credit

needs, supplies, and sales and the need for adequate training program. Indeed, data from

the FAO survey indicate that 34% of wholesalers and semi-wholesaler within the sample

expressed a need for training in management and accounting practices. As hypothesized,

the core has less access to formal credit than the periphery.

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Indeed, 81% of traders within the core do not have access to formal credit against 100% for traders within the periphery. This finding indicates that most of the private cereals marketing system depends on informal credit sources for working capital and investment. The fact that annual interest rates on informal loans can be as high as 30% against 18% in the formal sector (Dembélé et al., 1986) implies that the core must turn over its stocks at least two times in order to face the same cost of financing as the periphery.

The core is more involved in the domestic market than the periphery. Indeed, about 98% of the traders within the core deals only in domestic market compared to 8 % for the periphery. In contrast, 92% of the traders within the periphery are involved in export operations compared to 2% for the core. Thus, the efforts of the government to promote cereals exports must be directed primarily toward traders from the periphery.

The core and the periphery differ also in terms of scale of operation and concentration ratios. Indeed, the mean capacity in 1989 for owned and rented storage capacity for the core is 745 metric tons against 2,180 for the periphery. The average monthly sales figures in 1989 are 79 metric tons for the core against 587 tons for the periphery. It should be noted that the sales figures include rice for both traders within the core and the periphery. For cereals exports, the average figure is about 3477 metric tons for the periphery against 25 metric tons for the core. The concentration ratios, expressed in terms of the market share of the largest 4 traders and denominated as CR4, show the core to be less concentrated than the periphery. Indeed, the CR4 is 54% for the core against 87% for the periphery.

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Table 3.10   Empirical Result of the Cluster Analysis

	Core		Periphery		Total	
	N	(%)	N	(%)	N	(%)
Number:	42	76	13	24	55	100
Markets served:						
Domestic	41	98	1	8	42	76
Exports	1	2	12	92	13	24
Access to Formal credit:						
Yes	8	19	13	100	21	38
No	34	81			34	62
Formal Education						
Yes	6	14	7	54	13	24
No	36	86	6	46	42	76
Mean:						
Storage Capacity (tons)	745		2180			
Exports (tons)	25		3477			
Monthly Sales (tons)	79		587			
ABIL	0.6		2.9			

Source: Computed from field data, MSU-CESA-USAID, 1990

CHAPTER IV

4. Vertical Coordination in the Cereals Subsector and

Investment in Marketing Infrastructure

4.1 Physical Infrastructure and Institutional Setting

Marion classifies cooperatives, bargaining associations, transportation services, credit services, information systems, trade associations, and government programs as coordination mechanisms. This study considers the physical services and institutions cited by Marion as the facilitating milieu of vertical coordination.

4.1.1 Physical Infrastructure

A well-functioning marketing system requires the availability and the adequacy of storage and transportation facilities. The fact that cereals are produced once a year and are consumed all year round requires warehousing. Transportation facilities are needed to move the surplus of one area to meet the demand of the deficit area. Information about the sources of supply and demand must be available and accessible to all actors. Thus, storage facilities, transportation facilities, and the information and communication system constitute the basic physical infrastructure of the cereals trade.

4.1.1.1 Storage capacities

The location and availability of warehouses affect the efficiency of cereals marketing. A well-functioning cereals trade demands that grain be stored where it can be easily moved directly to places where it is in greatest demand at any time during the year (Milner, 1970). For export operations, the grain must be so located that it can be easily shifted easily abroad. Milner (1970) argues that "the location of stored grain must coordinate with other specialized marketing activities or functions."

Grain storage is carried out mainly at three levels in the marketing system. First, farmers store the bulk of the grain produced in their own granaries. Second, traders possess their own and rented storage facilities. Third, the public sector, consisting of OPAM and the Office du Niger, carry significant stocks. Although farmers tend to have the largest storage capacity, most of the grain stored at the farm level is not readily accessible during the rainy season in many parts of the country because many rural roads are impassable.

The mean storage capacity of farmers varies greatly from one agricultural zone to another. According to Harts-Broekhuis and Jong (1990), the mean storage capacity per farm household was 11 tons in the Koutiala region in 1989/90, 4 tons in the Koro zone in the region of Mopti, and 3 tons in the region of Gao. This finding suggests that farm-level storage capacity is higher in the surplus zones than in the deficit zone. Moreover, Harts-Broekhuis and Jong report that the average storage capacity per farm household at the national level has been estimated at 30 tons by many researchers.

A study carried out in 1989/90 by the national statistical service and the national agricultural service found a total of 1,851,193 granaries at the farm level for the whole country. The surplus region of Sikasso accounted for 31 percent of the total granaries, followed by Segou with 21 percent. Although the total storage capacity was not estimated, the available stock of grain in these granaries in September 1989 was evaluated at 609,959 tons. Stocks of less than 12 months accounted for 98 percent of the total. The total grain stock was made up of 52 percent millet, 32 percent sorghum, 10 percent rice, 5 percent maize, and 1 percent of other grain.

The total storage capacity of traders is not well known despite numerous marketing studies. An estimate of the total owned storage capacity of traders in the 10 major cities by Amselle in 1988 as reported by Harts-Broekhuis and Jong, indicates 95,000 tons. Of the

total capacity, the city of Bamako had 55,500 tons, Gao had 14,000 tons and Mopti had 14,000 tons. Thus, these three major consuming centers accounted for 84 percent of the total capacity.

The cities of Koutiala, Segou, and Bla, located in producing and surplus zones, had a total of 10,435 tons, or about 11 percent of the total capacity reported. The city of Kayes, which is a big urban center located in a deficit zone, had a total storage capacity of 2,180 tons. This low figure contrasts sharply with the 14,000 tons for Gao, which is also located in a deficit zone. The low figure of Kayes may reflect either inaccuracy in the estimate or the undeveloped marketing infrastructure in that city. It may also reflect the fact that Kayes is on the rail line, and hence may have access to regular supplies from Bamako, which reduces the need for traders to hold large cereals stocks. In contrast, prior to the paving of the Mopti-Gao road, access to Gao was much more difficult; hence traders may have had to hold large stocks.

The storage capacity of the public sector, mainly OPAM, totals 110,000 tons, slightly more than that reported for cereals traders. Of this total, OPAM uses only 58,000 tons for the national security stock. This leaves 52,000 tons which can be rented by the private sector. However, this capacity is concentrated in Bamako and in the producing zones. For example, OPAM possesses 50,000 tons in Bamako, 36,000 tons in Segou and 8,000 tons in Koutiala. Although OPAM possesses idle capacity of 52,000 tons, only 24,930 tons were rented in 1990 to the private sector, compared with 10,900 tons in 1993. In addition to OPAM, the Office du Niger has storage capacity well in excess of 60,000 tons.

The distribution of storage capacities indicates that the major consuming urban centers possess the bulk of commercial storage facilities, while the producing zones have low capacities. This pattern indicates that grain is stored by farmers and by traders from urban

centers. Storage facilities of urban centers located in producing zones seem to be used as temporary facilities to aggregate the small supplies coming from different rural markets for shipment to consuming centers. As temporary facilities, their capacity seems to be in concordance with the economic size of truck shipments. For example, according to Amselle's data, the mean storage capacity of traders in Koutiala was 60 tons and the usual truck shipment between producing zones and consuming centers is about 30 tons.

4.1.1.2 Transportation facilities

Efficient spatial arbitrage between markets requires the availability of transportation facilities. Poor transportation infrastructure prevents not only the smooth movement of cereals between surplus and deficit zones, but raises the total marketing cost. Given the fact that most of the grain is stored on the farm, the quality of rural roads becomes an important determinant of the marketing cost and of the continuous flow of cereals from surplus to deficit zones all year round.

Little attention has been paid to the construction and the maintenance of rural roads in Mali. According to Harris-Broekhuis and Jong (1990), a good part of the countryside is unaccessible during the rainy season. Rural transportation infrastructure is well-developed in the CMDT zones where the rural roads must be developed and maintained to move cotton out and to distribute the necessary agricultural inputs. In contrast, the agricultural zones that grow only cereals have received little government assistance for rural roads development. These are the producing of Segou, Mopti, Koulikoro, and Kayes except in limited areas of OHV zones where USAID has invested in rural areas.

The deficit zones of Tombouctou, Gao, and Kayes have practically no paved rural roads, and grain movement within these zones is difficult during all seasons of the year. However, the city of Gao is linked to the rest of the country by a well-paved road, while the

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city of Kayes is linked to Bamako by railroad. For the regions of Gao and Tombouctou, the Niger river is the most important low cost transportation facility. This waterway plays an important role in the shipment of grain to these regions. Unfortunately, the waterway is only accessible to large vessels from July to November (Steffen, 1992).

All major urban centers except Tombouctou are well connected to Bamako, the capital city of the country. The total road infrastructure of Mali is estimated at 14,544 kilometers. Of this total, 47 percent is practicable during all seasons and 53 percent is inaccessible during some periods of the year (Harts-Broekhuis and Jong, 1990). For overseas trade, the country depends mainly on the seaports of Abidjan in Côte d'Ivoire and of Dakar in Senegal. The main cereals exporting centers are linked to Abidjan by a good road network of 1,300 kilometers and to Dakar by 1,290 kilometers of railroad. However, cereals exports to Mauritania are constrained by the lack of well paved roads compared to exports to Côte d'Ivoire (Gabre-Madhin, 1992).

Grain moves from producing zones to the major consumption centers by trucks. According to data from the national transportation service (ONT), there were a total of 1,399 trucks in the country in 1987 for a total capacity of 27,780 tons. Bamako, the major consumption center, had 43 percent of the total number of trucks, while the surplus regions of Segou and Sikasso accounted for 46 percent of that total. This distribution of the trucking capacity is in line with the movement of cereals and cotton within the country. Indeed, most of the marketed surplus originates from Sikasso and Segou, while Bamako is the major importing and dispatching center of the country.

Although there is a lack of empirical evidence on the adequacy of transportation capacity, Harts-Broekhuis and Jong argue that transportation capacity is inadequate because of its concentration in Bamako and the surplus zones and the old age of most of the trucks.

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However, the concentration of the trucking capacity reflects the distribution of the economic activities between the regions of the country. Indeed, most of the imported goods are concentrated in Bamako before they are sent out to the rest of the country. Thus, truckers from Bamako ship imported goods to other regions and bring back cereals and other agricultural products. Similarly, truckers from the surplus zones transport cereals to the consuming centers and return with imported goods from these centers. The deficit zones of the North rely more on the Niger river for their grain supplies. The region of Kayes depends on the railroad for its grain supplies. The fact that rail and water shipment may be cheaper than truck shipment may explain also why these zones had only 5 percent of the total trucking capacity of the country in 1987.

4.1.1.3 Market information structure

Any marketing system requires the availability of an information structure. This structure determines what market information is available and what communication channels and technology transactors use to access that information. Neoclassical economic theory states that prices are the most efficient means to allocate resources within an economy when they are determined through a competitive process. Such prices reflect all essential market information, and their variability reflects changes in the underlying conditions of supply and demand.

The fact that prices that are competitively determined reflect all essential market information means that they relieve transactor of the need to gather and process information concerning all other factors affecting supply and demand (Shaffer et al., 1983). Thus, prices allow the transactor to economize on the gathering and processing of information concerning all the details of changing market conditions because other people in the system have already taken it into account. Hence, the availability of prices derived

competitively has a bearing on the efficiency and the level of vertical coordination of any marketing system.

The sources of price information and the existing communication channels and technology determine the accessibility of that information. Economy of scale in price information gathering means that large firms will have an advantage over smaller firms, as they can spread the cost of information collection over large transactions. Thus, private sources of price information will lead to imbalance in access to that information. This calls for public provision of essential market information to improve coordination.

Traders get price information from both private and public sources in the Malian cereals sub-sector (Table 4.6). The primary private source of price information for the majority of traders is other traders and their own suppliers. Family members, friends and transporters are also important sources of price information regarding supply conditions.

Table 4.1   **Sources of Price Information and Market Conditions for Supply Sources**

Sources	Wholesalers		Semi-wholesalers		Total	
	N	Pct	N	Pct	N	Pct
Other traders	43	84	46	89	86	86
Own suppliers	48	96	46	89	91	92
Family and Friends	35	71	37	73	69	71
Transporters	32	63	28	55	58	59
Own agents	27	54	25	48	50	51
SIM broadcast			25	50	44	46
SIM bulletin	9	18	1	2	10	10

Source: CESA-MSU-USAID Food Security Surveys, 1988/89
(Steffen, 1992)

This ranking of information sources does not change when it comes to price information in sales locations (Steffen, 1992). Public sources of price information were used by less 50 percent of all traders surveyed by Steffen. In contrast, 91 percent of the traders in the surplus producing zones of the country surveyed by Steffen relied on the market information system (SIM) weekly radio broadcast for their price information and market conditions for supply sources. Another 87 percent of these traders from producing zones depended on the SIM price broadcast to get price information in their sales markets (Ibid). However, Steffen's survey was done when the market information system was less than a year old. The survey covered only wholesalers and semi-wholesalers and the cities of Gao, Tombouctou, Mopti, Segou, Koutiala, and Bamako. Thus, traders' reliance on public information sources may have changed since then.

Traders use personal contact and telephone communication to convey market information within well-defined trading networks. The recent privatization of the national telephone company, which led to the multiplication of public phones in many cities, has dramatically altered the communication technology. For example, 48 percent of all traders (wholesalers and semi-wholesalers in 6 cities) surveyed by Steffen in 1988/89 had a telephone or easy access to a telephone, while 98 percent of these traders were using the telephone for their grain trade.

Traders use more and more telephone communication for transactions between regions and rely on personal contact communication for transactions within regions and within urban markets. However, no matter what communication technology is used, a trader must belong to a trading network in order to access private market information. For example, 92 percent of all wholesalers and semi-wholesalers (in 6 cities) surveyed by Steffen got price information about supply sources from their suppliers in 1988/89, and 88 percent

of them relied on their own retailers to get information about their sales markets. This gives an advantage to the core (which is a constellation of these networks) over the periphery.

The reliance of traders from the surplus zones on the SIM radio broadcast reflects the state of communication technology in rural areas and the periodicity of the SIM information. Indeed, there are no telephones in rural areas and price information must be communicated through personal contact. This price information is weekly, as most rural markets are held once a week. Thus, the weekly diffusion of rural prices is consistent with the periodicity of that information. With 97 percent of the traders from Koutiala in the surplus South who rely on their own agents to get rural markets price information (Steffen, 1992), the SIM weekly price broadcast allows these traders to cross-check the declarations of their agents.

The SIM uses the national radio and television to broadcast weekly producer and consumer prices. This price information helps to improve the bargaining power of farmers and allows traders outside the core to get multi-market price information. However, traders need daily information about prices and the conditions of supply and demand in major urban markets. Although the SIM has initiated the collection and diffusion of information concerning stock variation and the level of transactions in major cities, the weekly nature of this information makes it less useful to most traders.

The efficacy of the existing market information structure in conveying relevant information can be measured by how well traders think they are informed about the cereals market conditions. According to Steffen (1992), 87 percent of traders in the deficit North considered themselves to be well-informed about the grain market. The figure is 100 percent for traders from Koutiala in the South and from the city of Mopti. Only 71 percent
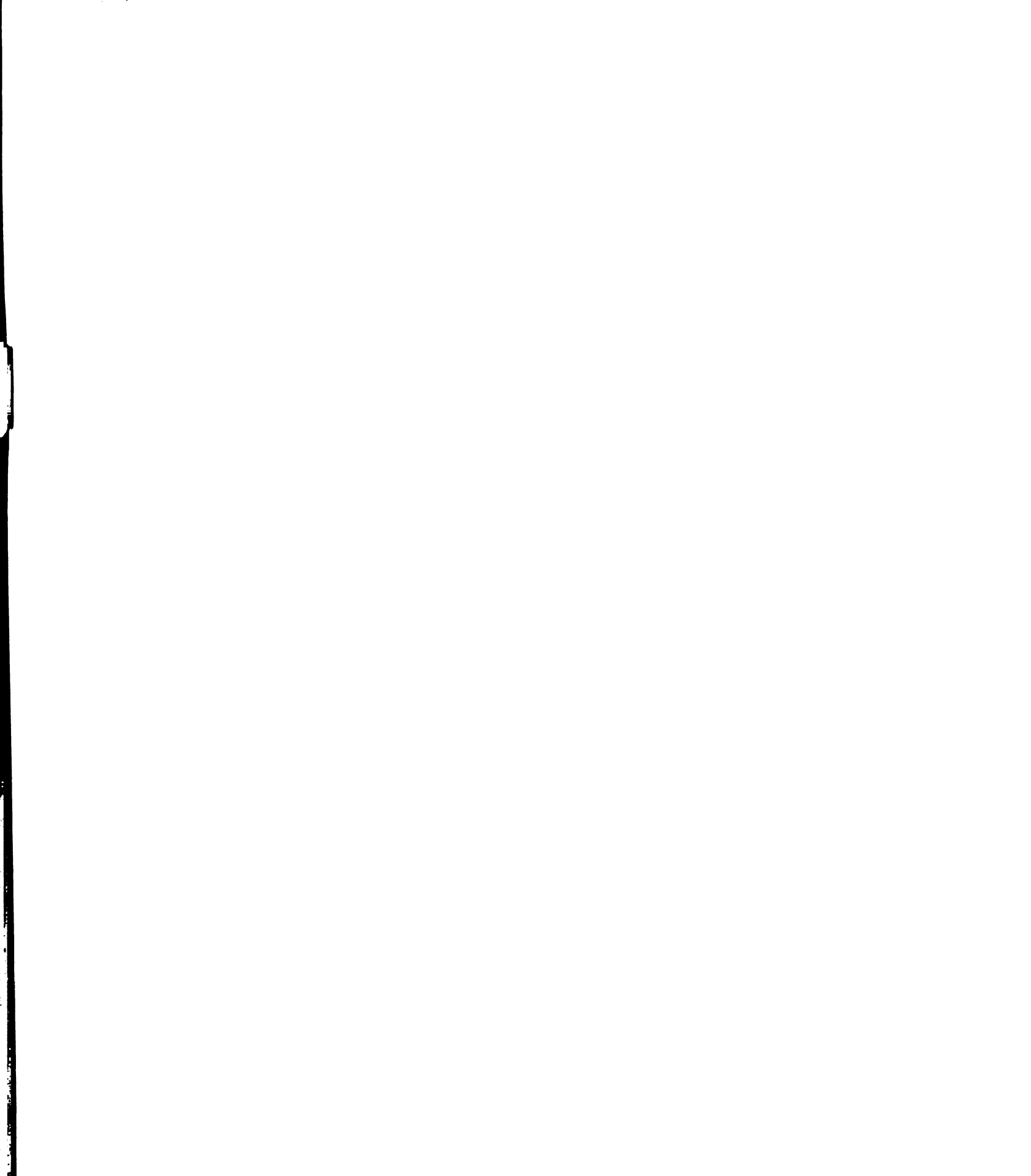
of traders from Bamako believe they get adequate information from the existing market information structure.

Although the existing market information structure provides adequate price information to most traders for domestic marketing, it fails to link the domestic and international markets through the provision of information concerning external markets. Only the periphery is well-connected to international markets, as the large traders possess telephones and fax machines and international correspondents. Thus, the existence of scale economies in the collection of information concerning international markets constitutes an important barrier to entry in the cereals import and export business for most traders.

Another shortcoming of the existing market information system relates to its inability to provide adequate information for contracting purposes. For example, there is no private or public organized system that reports the credit rating of transactors, and traders must expend resources to get information about the creditworthiness and the reliability of potential trading partners. Again, this type of information is available within restricted trading networks within the core. The existing Chamber of Commerce, which could provide such information, is dominated by big traders from the periphery who are more concerned about external markets.

The overview of the existing physical infrastructure shows the inadequacy of rural road and communication infrastructure and the availability of storage capacities within the cereals sub-sector. The deficit zones lack trucking capacity, and the information structure fails to provide relevant information concerning creditworthiness and reliability of transactor and international markets for most traders. These deficiencies of the physical infrastructure have profound implications for traders' choice of available coordination mechanisms.
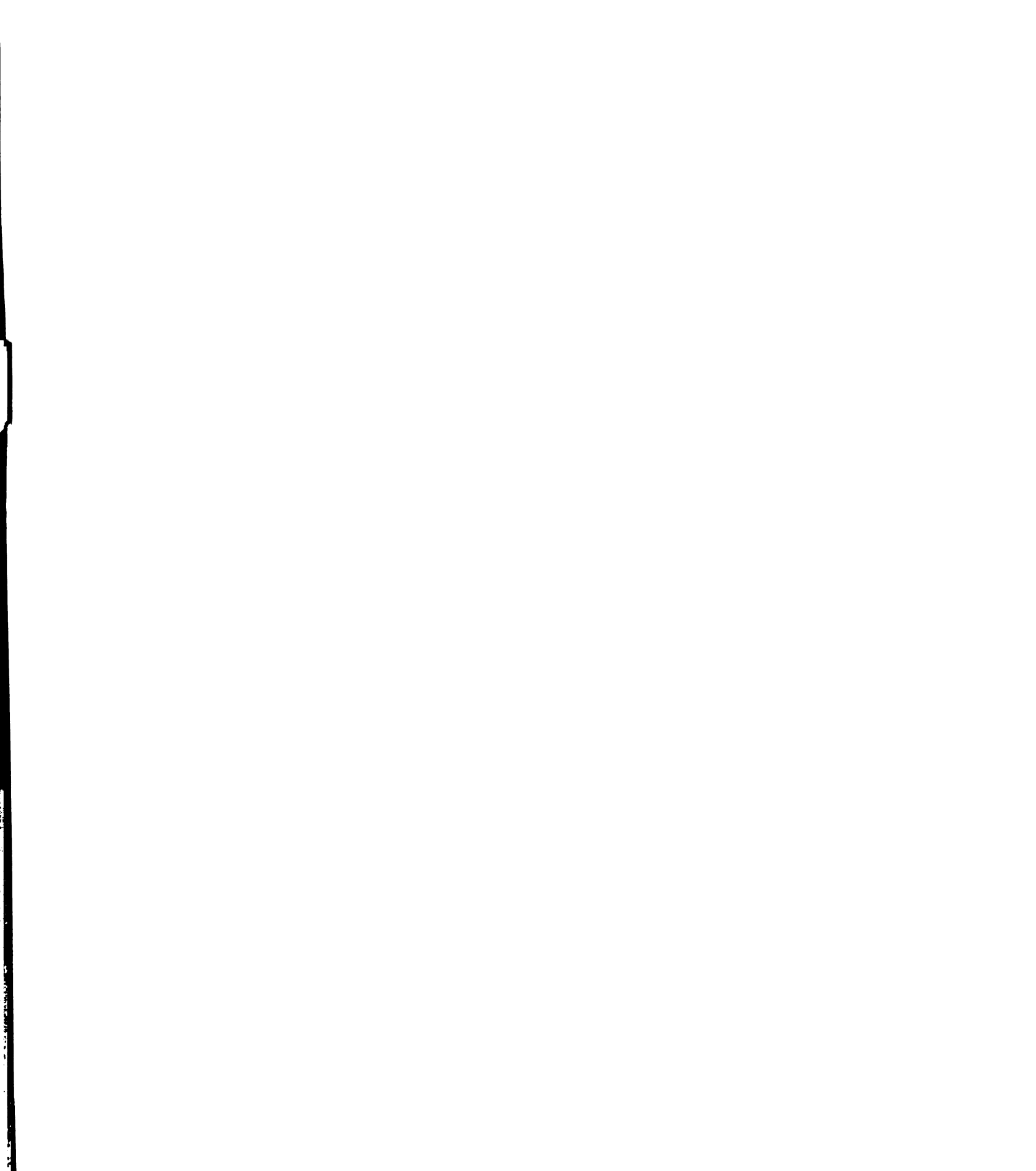
4.1.2 The Institutional setting

The existing institutional setting is very important for vertical coordination because of its influence on human interdependence. According to North (1991), the existing institutions of society reduce behavioral uncertainty by establishing a stable structure of human relationships. These institutions include both the social conventions that define the norms of behavior and the statute law of the state.

Social institutions establish a stable structure of human relationships through the definition of the rules of the game, property rights, and systems of sanctions to enforce the rules and property rights. The ability of social institutions to reduce behavioral uncertainty depends on transactors' access to the systems of sanctions and their cost effectiveness. However, the effectiveness of the systems of sanctions depends on people's perceptions of the legitimacy of the system. For the cereals subsector, the relevant institutional setting includes the norms of behavior and the statute law that define trading rules and govern contractual relations.

4.1.2.1. Norms of behavior

Shared norms of behavior are social institutions designed to reduce behavioral uncertainty that results from human interaction. They specify what the individual should do in a given situation and provide him with information regarding the likely actions of others. Thus, norms of behavior have an informational role in human interaction. The consequence of this informational role of routinized norms of behavior is that regular and predictable behavior is possible despite the complexity of the environment, uncertainty, and information load (Hogson, 1988).

According to Hogson, the existence of any business community is dependent on a set of informal customs and rules which have to be acquired by all participants. An

individual must act in conformity with these sets of customs and rules before he can be accepted in the community. Moreover, acting in conformity with these customs and rules enables a potential entrant to earn the trust of others.

Behavioral norms create role expectations. For example, Egan and Mody (1992) found that American buyers expect their suppliers from developing countries to deliver on time and to meet quality norms. Suppliers who meet regularly these expectations earn the trust of American buyers and build a reputation for their countries. Once built, such reputation becomes an asset for both American buyers and their foreign suppliers as it provides stable behavioral expectations.

In the Malian context, the choice of a commercial partner tends to be based on diffuse relationships rather than on rational criteria. Diffuse relationships require that each member of the group knows every other member in his totality through constant contact. Traders are expected to respond not only to specific demands related to grain trade such as timely delivery, but also to help each other in case of business failure. Group solidarity is highly valued and there is a strong desire to preserve the relationship with the extended family and the group.

Although traders expect timely delivery, prompt payment, and maintenance of quality norms from their partners, these expectations are made flexible because of the risk involved in grain trade. For example, late delivery and payment are accepted when they reflect objective difficulties of the trading partner. The evaluation of temporary difficulties experienced by a partner poses less of a problem when the trader belongs to a tight trade network because information about the financial position of fellow traders is cheap.

The diffuse trading relationships serve three useful purposes. They·serve to lower information cost in exchange, to provide insurance in case of business failure, and to

cheapen the administration of sanctions (Eggertsson, 1990). Within a tight trading network, information about market conditions and the performance of trading partners is made available to the members. To provide insurance, traders adopt reciprocal exchanges, late payment and delivery, and group obligations. High prestige is attached to helping a partner during difficult times. Sanctions are administered by the group through voiced disapproval and bad publicity (See Schmid, 1987).

Diffuse relationships diminish as one moves from local to intra-regional trade, and to transactions between the core and the periphery. The trading networks tend to be tighter in a given market than networks across different markets. However, within the core, information about fellow traders is shared across markets. For example, trade networks in Koutiala share information about traders in that city with other traders in different cities. The tendency is for traders from surplus zones to have partners in urban cities who provide them with information about potential clients (Dembélé et al., 1986).

The urban partner provides not only information to their counterparts from surplus zones, but he also serves as broker and credit collector. Thus, the urban partners enjoy diffuse relationships with their counterparts from producing zones, while other urban traders are accepted on a specific relationship basis. The specific relationship rests on specific demands such as timely delivery, prompt payment, and other contractual requirements. In the specific relationships, the trader is interested only in the relevant aspects of the relationships useful to his grain trade.

Within the core, urban partners provide information about the credit rating of urban traders with whom their counterparts from producing zones entertain specific relationships. Thus, these specific relationships depend entirely on the credit rating system of the urban partners. Indeed, urban partners are expected to bear full responsibility for bad credit that

results from the specific relationships they recommend to traders from producing zones. However, the situation is different regarding the specific relationships between traders from the core and traders from the periphery.

Because traders from the periphery are large-scale and tend to trade with public institutions and international buyers for local grain, timely delivery and quality requirements are more stringent. Quality variation and failure of traders from the core to make timely delivery create costs for traders from the periphery. Thus, the periphery lacks flexibility in its contractual expectations vis-a-vis the core, where flexibility is an accepted norm. This contradiction can be explained by the fact that the large traders from the periphery can use diversification as a risk management strategy while traders from the core are too small to spread the risk of business failure and depend on flexibility and group solidarity to manage marketing risk.

In contrast to the core, which depends on social pressure to enforce and stabilize behavioral norms, traders from the periphery can access the court enforcement mechanisms. Indeed, it is generally accepted in Mali that a credit dispute must be worth at least 100,000 CFAF before it can be brought to court. This represents about 2 tons of coarse grain at an average price of 50 CFAF/kg, which is more than any single transaction between wholesalers and retailers or between wholesale assemblers and rural assemblers.

Social pressure within the core is effective because the cost of losing the confidence of the group may be high for a trader who depends on grain trading for a living. In contrast, traders from the periphery can diversify and manage their own marketing risk and are more dependent on formal sources for credit. The difference in ability to manage marketing risk between the core and the periphery creates a difference in expected behavioral norms. Thus, expected behavioral norms within the core are designed for both

coordination and risk management, while in the periphery, expected behavioral norms are assigned only the task of coordination. These expected behavioral norms and the statute law setting define the availability of coordination mechanisms.

4.1.2.2 The statute law

The statute law and social norms define the rules of the game. These rules are a matter of public choice (Schmid, 1987). However, North has argued that the formal rules tend to be a mere codification of accepted social norms even if the state may innovate in changing the rules. Indeed, the effectiveness of the rules of the game depend not only on the ability of the state to enforce them, but also on people's perception of the fairness and conformity of these rules to accepted codes of conduct.

In Mali, the formal rules of commerce come from the French statute law and do not always reflect the accepted social norms. For example, the high status attached to giving and sharing in Malian society compels traders to support members of the extended family. The expenses that result are socially accepted as legitimate costs for the business, but they are not tax deductible as far as the Malian tax code is concerned. The current statute law tends to encourage capital accumulation while the social norms emphasize the insurance principle by which traders must provide survival security for the group.

The Bank for Development of Mali (BDM), which suffered heavy financial losses from the collapse of the modern economy, organized a seminar in 1991 to find out about the causes of the crisis of the modern enterprise in Mali. The seminar reached the conclusion that the inadequacy between the accepted norms of behavior and the modern standard operating procedures explained most of the crisis. Indeed, some of the main findings of the participants indicated that managers of the modern enterprise were forced through group pressure to respond to social demands at the expense of efficiency. For

example, managers could hardly use such criteria as skills, achievement, and ability to hire workers. In addition, managers could not fire workers or change suppliers and distributors because the workers, suppliers, and distributors were imposed upon them by the social group.

The Malian code of commerce, derived from the French statute law, defines the qualities of a trader, the rules of business conduct, and the legal aspects of contracts. The code defines a merchant or trader as any person who engages in the exchange of goods and services for himself (Code du Commerce, 1986). The merchant must be fifteen years old, exempt from any condemnation for criminal charges such as corruption, deceit, fraud, usury, bad checks, stealing, and speculation (speculation refers to holding goods off market to raise their prices). These requirements aim at reducing behavioral uncertainty through the imposition of norms of honesty in trading. However, it is nearly impossible for the state to identify the honest person who applies for registration as merchant with the Chamber of Commerce.

The trading rules require sellers to deliver receipts to buyers for all transactions, to maintain timely accounts of their operations, and to provide the state with a monthly report of the level of stock of goods of vital necessity such as grain, sugar, and cooking oil. Retailers are required to list the unit price of the products they sell. The code prohibits collusion and price discrimination such as price discounts destined to undersell the competition.

Although the Malian statute law has all the ingredients of modern business contractual law, enforcement remains a problem. Indeed, informal discussions with traders reveal that corruption, the requirement of written records and witnesses, and lengthy processes discourage them for using the court system. However, the police are accepted in

Mali as an alternative to the court system to settle contractual disputes regarding small claims. Unfortunately, the effectiveness of the police dispute settlement mechanisms is diminished by corruption and the heavy social pressure that many police officers face in their neighborhoods.

4.2 Coordination practices within the cereals subsector

The structure of cereals supply and demand, the physical infrastructure, and the institutional setting determine to a great extent the range of coordination mechanisms available to traders. These factors vary by regions within the country; consequently different combinations of coordination mechanisms will be observed at different levels in the private marketing system in different regions. However, only two levels of coordination are examined here: coordination of rural assembly and wholesale assembly and coordination of wholesale assembly and urban wholesaling. Urban wholesaling includes export operations and formal contracts with OPAM and non governmental organizations (NGOs).

4.2.1. Coordination between rural assembly and wholesale assembly

Rural assemblers are the first link between producers and the marketing system. They assemble between 60% and 80% of rural marketed supply in producing zones (Dembélé et al., 1986). As already stated, rural assemblers are either independent traders who finance their own operations, or they are agents of wholesale assemblers who finance their operations.

The average weekly volume handled by a rural assembler in any given rural market has been estimated at 200 kgs in the CMDT zone (Dembélé et al., 1986). The fact that most farmers sell on average between 1 and 10 kgs of cereals means that an assembler must reach at least 20 farmers on any given market day. Thus, the structure of rural supply demands that many assemblers be involved in the process of aggregating of rural supply.

However, the coordination of the actions and decisions of this multitude of assemblers constitutes a challenge for the marketing system.

Most transactions between farmers and assemblers are spot-market transactions. Once the farmer and the assembler agree on the price, both the transfer of the property right of the grain to the assembler and the payment to the farmer are made simultaneously. Credit is rarely involved in cereals transactions between a farmer and an assembler except when a lasting relationship has been established between the two. Thus, the necessity of assemblers to pay cash for most of their transactions means that the level of producer price is determined to a large extent by the financial position of these traders during any given day once farmers have brought their grain into the market. Indeed, given the small size of the individual lots, it may not be worth the effort of the farmer to return home with his grain even if he judges the price level to be too low.

The mediation between rural assembly and wholesale assembly is carried out by different coordination mechanisms depending on the producing zones. The main coordination mechanisms are spot-market transactions within known marketing relationships, contractual arrangements, and vertical integration by ownership. Contractual arrangements usually involves the pre-financing of an assembler or agent by a wholesale assembler. Vertical integration by ownership involves the use of relatives by a wholesale assembler for grain assembly in rural markets.

Camara and Monette (1992) report that coordination between rural assembly and wholesale assembly is carried out by spot-market transactions in the regions of Kayes and Koulikoro. They found in the region of Koulikoro 1992 that 71% of wholesale assemblers used spot-market transactions to acquire supplies from other assemblers and producers, and 87% of wholesale assemblers from the region of Kayes used spot-market transactions to

acquire their supplies. Few traders in these regions use contractual arrangements with

assemblers. In contrast, about 91% of the wholesale assemblers in Koutiala rely on

contractual arrangements with assemblers as their first source of supplies (see table 4.2

below). Spot-market transactions constitute the second most important source of supplies

for 46% of the wholesale assemblers in Koutiala.

Although the instability of marketed surplus in the regions of Koulikoro and Kayes

may be an important factor, the use of spot-market transactions to coordinate the flow of

cereals between assembly and wholesale assembly can be explained by the poor transporta-

tion and communication infrastructure in these regions. Indeed, Camara and Monette (1992)

report that the poor transportation and communication infrastructure in these regions makes

some markets inaccessible to traders.

Table 4.2   Contractual Practices Of Wholesale Assemblers

	Wholesale assemblers Koutiala	
	Number	Percentage
Most important source of supplies		
Contracts with assemblers	10	90.9%
Spot-market transactions	1	9.1%
Share of contracts in total supplies		
More than half	6	54.5%
Half	5	45.5%
Less than half	-	-

Source: CESA-MSU-USAID field surveys (1990)

This inaccessibility means that traders can visit some rural markets only infrequently, the traders face high cost of monitoring their agents, and must deal with unpredictable supply delivery by assemblers. Indeed, Camara and Monette (1992) indicate that delays in supply delivery and the fact that assemblers can easily disappear when pre-financed explain why traders use spot-market transactions.

The reliance of wholesale assemblers from Koutiala on contractual arrangements with assemblers for more than half of their supplies may be explained by the good rural road infrastructure. In the Koutiala zone, the standard contractual practice is for a wholesale assembler to advance cash to an assembler in the morning and to receive delivery at the end of the day, when the trucks return from rural markets. Thus, the pre-financing of assemblers by wholesale assemblers does not exceed one day, as most rural markets covered are well connected to Koutiala within a radius of less than 100 kms (Dembélé et al., 1986).

The mode of payment of assemblers in Koutiala tends to stabilize the flow of grain delivery. For example, in Koutiala, the price of grain delivery is fixed in the morning when cash is advanced to the assembler. The assembler is paid the difference between the agreed upon price and the producer price of the relevant rural market. Thus, the gross revenue of the assembler varies directly with the producer price and the quantity delivered. With positive correlation between producer price and quantity delivered, the assembler has incentives to reduce the variability of the volume of grain delivered in order to reduce the overall variation of his gross margins given the stable nature of marketed surplus of the region.

This payment mechanism works in Koutiala because the good road infrastructure has led to a high degree of market integration in the south CMDT (Dioné, 1989). Therefore,

knowing the price in Koutiala gives the wholesale assembler and the assembler in Koutiala a fairly good idea of what the rural price will be, hence what the assembler will earn as a commission. This cuts down the need to monitor the assembler. It also gives him a fairly predictable margin per kg as long as he "plays by the rule". In contrast, the region of Kayes, where prices are more unpredictable and the time to assemble grain is longer due to the poor infrastructure, wholesale assemblers face a principal-agent problem, and spot market transactions will replace contractual arrangements.

4.2.2 Mediation between wholesale assembly and urban wholesaling

Contractual arrangements constitute the dominant coordination mechanism that links wholesale assembly and urban wholesaling. For example, 50% of urban wholesalers from Bamako and 43% from Mopti have a contract with their suppliers (see table 4.3 below). All wholesale assemblers from Koutiala have regular clients in urban centers to whom they sell regularly. However, most of these contracts are not written contracts and are best qualified as informal contracts or clientelism.

Most of the cereals transactions between wholesale assemblers and urban wholesalers are governed by informal contracts. For example, contracts account for more than half of the total volume of cereals purchased for 94% of urban wholesalers from Bamako, and for half or more for 100% of urban wholesalers from Mopti (see Table 4.3 below). All wholesale assemblers from Koutiala depend on their regular clients for more than half of their total cereals sales. The standard informal contract is for a wholesale assembler from producing zones to send a truck load of cereals to an urban wholesaler on credit for one to two weeks. Once the urban wholesaler has sold the grain, he pays back the wholesale assembler. However, it is common practice for an urban wholesaler to advance cash to a wholesale assembler when urban demand rises.

The major terms of the standard informal contract concern the quantity of cereals to be delivered, the price, and the period of delivery and payment. The typical terms of contract between a Koutiala wholesale assembler and a Bamako wholesaler will call for the delivery of a certain quantity of sorghum, millet, or maize, with quality determined at delivery time, the payment in one week after delivery, and the price set equal to the prevailing market price at the time of delivery.

Table 4.3   Contractual Arrangements between Urban Wholesalers and Assemblers

	CITY					
	BAMAKO		MOPTI		KOUTIALA	
	(N)	(%)	(N)	(%)	(N)	(%)
Contracts with suppliers						
YES	14	50%	6	43%	11	100%
NO	14	50%	8	57%	-	-
Share of contracts in total supplies						
More than half	16	94%	8	57%	-	-
Half	-	-	6	43%	-	-
Less than half	1	6%	-	-	-	-

Source: CESA-MSU-USAID field surveys (1990)

These terms are rarely respected. For example, 66% of urban wholesalers from Bamako, 25% of urban wholesalers from Mopti, and 100% of wholesale assemblers from Koutiala report that the non delivery of the quantity specified constitutes the most common contractual problem (table 4.4). Late delivery of cereals was cited by 80% of these same traders as the second major contractual problem of the grain trade (Table 4.4). Although field observations reveal that most urban wholesalers recognize that they cannot pay their suppliers on time, the coordination of wholesale assembly and urban wholesaling requires the extension of credit by wholesale assemblers to their urban counterparts. For example, purchases on credit account for half or more of total purchases for 65% of urban wholesalers from Bamako and for 71% of urban wholesalers from Mopti. Only 17% of wholesale assemblers from Koutiala make half of their purchases on credit from assemblers. Thus, urban wholesalers depend more on suppliers' credit than wholesale assemblers. For example, Dembélé et al., (1986) report that most of the cereals transactions between producing zones and urban centers are pre-financed by wholesale assemblers.

Both urban wholesalers and wholesale assemblers rarely use the court system to enforce their contractual agreements. For example, 84% of urban wholesalers from Bamako and 89% of urban wholesalers from Mopti try to work things out with their suppliers as their first recourse to settle contractual disputes. Urban wholesalers from Bamako try to change suppliers as their second recourse to settle contractual disputes.

Table 4.4 Contractual Terms most Likely to be Violated by Suppliers

	BAMAKO		MOPTI		KOUTIALA		TOTAL	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Term most frequently violated								
Quantity specified	4	66%	1	25%	11	100%	16	76%
Price	1	17%	1	25%			2	10%
Period of payment	1	17%					1	4%
Period of delivery								
Quality of cereals			2	50%			2	10%
Total	6	100%	4	100%	11	100%	21	100%
Second most likely term violated								
Price	1	33%			1	10%	2	13%
Period of delivery	1	33%	2	100%	9	90%	12	80%
Quality of cereals	1	33%					1	7%
Total	3	100%	2	100%	10	100%	15	100%

CITY

Source: CESA-MSU-USAID field surveys (1990)

All wholesale assemblers from Koutiala attempt to work things out with their urban

counterparts as the first alternative to the legal system (Table 4.5). Thus, the contractual

arrangements that coordinate wholesale assembly and urban wholesaling do not use the

court system to enforce contractual agreements. Moreover, these contractual arrangements

are very flexible with regard to the periods of delivery and payment and the quantity

specified. The non-recourse to the court system and the flexibility of contractual

arrangements characterize the core, which coordinates the wholesale assembly and the urban

wholesaling.

Table 4.5   Enforcement of Contractual Agreements by Traders

First actions when contracts are violated	CITY					
	BAMAKO		MOPTI		KOUTIALA	
	(N)	(%)	(N)	(%)	(N)	(%)
First action						
Work things out	10	84%	8	89%	11	100%
Change suppliers	1	8%	1	11%		
Other	1	8%				
Second action						
Change suppliers	6	100%				

Source: CESA-MSU-USAID field surveys (1990)

4.3   Traders' Investment

The cereals market reforms of 1981 in Mali were based on the assumption that the

removal of legal constraints to private trade would be sufficient to induce rapid investment

by traders in marketing infrastructure and employment. In contrast, Kydd and Scarborough

(1989) argue on theoretical grounds that the lack of access to credit constrains the private sector's ability to invest in marketing facilities such as warehouses and trucks. Chataigner (1989) also claims that the marketing of agricultural products for the domestic market lacks its own warehouses and trucking facilities, and depends more on the infrastructure of international trade in West Africa.

Although marketing research in Mali since the initiation of the market reforms of 1981 suggests that the private sector is able to allocate the supplies of already-produced grain efficiently, its response to the reforms in terms of investment has not been empirically established. This section analyzes traders' investment in storage and trucking capacity, the evolution of storage and trucking capacity and changes in employment before and after the reforms of 1981.

4.3.1 Evolution of Traders' Investment

Stiglitz and Greenwald (1990) argue that reduction in uncertainty and increases in historical profits lead to increased investment. This statement suggests that changes in the Malian cereals which reduce marketing risk would lead to increased investment. Prior to the market reforms, it was riskier for traders to have their stocks concentrated in one or two locations, as these stocks could be seized. Moreover, grain movement over long distance in truck loads was riskier, as both the trucks and the grain could be seized by the government. Once grain trading became legal, the risk of seizure was removed, and traders could concentrate their stocks in larger warehouses and move grain in trucks between producing zones and urban centers to gain economies of scale. Thus, it is hypothesized that average net investment in storage and trucking capacity is higher for the post-reforms period than for the pre-reforms period.

Birch and Siebert (1976) have shown that the firm views its demand as consisting of permanent and transitory components, and only changes in permanent demand affects the firm's investment behavior. Changes in the transitory component lead the firm to move along its short run cost curve, while increases in permanent demand cause the firm to change its capital stock. With stable prices, anticipated permanent demand consists of anticipated permanent sales. For Birch and Siebert, the optimal capital stock grows with increases in anticipated long-run optimal sales.

The anticipated increase in permanent demand in the Birch and Siebert model can be identified with the market share of OPAM turned over to the private sector after the reforms. Moreover, the volume of sales through permanent relational contracting corresponds to traders' permanent demand, while the transitory component of their demand can be identified with sales through irregular and unanticipated spot market transactions, cereals exports, and governmental contracts. As a result, it is hypothesized that:

- Because the core deals in the domestic market, while the periphery is more involved with unstable exports and governmental contracts, traders from the core are likely to invest faster than traders from the periphery after the market reforms;

- Because traders with contractual arrangements (defined as relational contracting) have more predictable demand than traders who rely on spot market transactions, they are likely to have higher average net investment than traders who rely on spot market transactions.

4.3.1.1. Data Sources

The data used to test the above hypotheses and subsequent ones in the chapter come from a group of 55 traders drawn from the sample of traders of the MSU-CESA-USAID Food Security Project in Mali. Of the 55 traders, 30 are from Bamako, 14 are from Mopti, and 11 are from Koutiala. Thus, the sample comprised 44 urban wholesalers and 11 wholesale assemblers.

The choice of Bamako, Mopti, and Koutiala reflects their importance in the cereals trade. Bamako is the biggest urban center in Mali where most of the urban demand is located. Moreover, Bamako connects all of the producing zones of the country and supplies the consumption of the deficit zones of the region of Kayes and Koulikoro. Mopti connects mainly the producing zones of the South and the center of the country to the deficit zones of the regions of Tombouctou and Gao in the North.

Koutiala is located in the largest producing zone of the country and connects most of the rural markets of the South to the national market. Koutiala supplies both Bamako and Mopti. Indeed coefficient of price correlations between the three cities show that cereals prices movements are similar in all cities (Mehta, 1989; Dioné, 1989). Thus, most of the dynamics of cereals trade in Mali are captured by the trading relationship between these three cities.

Traders were not classified into wholesalers and semi-wholesalers because of the following reason. The classification of traders into wholesalers and semi-wholesalers is based on the level of sales determined by the researcher. However, the level of sales varies greatly within years and between years. Thus, the classification is unstable, and a trader classified as semi-wholesaler during one month may become a wholesaler during the following month. Indeed, informal discussions with traders show that most of them tend to

have high volume of operations during the months of harvest which declines progressively over the months.

The data were collected through direct retrospective interviews between March and May of 1990 with two different questionnaires. The data were updated in June 1993 through informal discussions with traders. The first questionnaire collected data on the socio-economic characteristics of traders, changes in their scale of operations in terms of investment and employment creation over time, and their evolving marketing strategies over the years. The second questionnaire collected data on traders' use of different coordination mechanisms.

Given the retrospective nature of the interviews, the quantitative data may be subject to inaccuracy. But, traders tend to remember accurately big investments and the quantities they purchase and sell regularly. To avoid inaccuracy in the data set, the periods of reference for most questions were the period of entry in the cereals trade and the current state of the business of the trader in 1989. However traders were asked to provide the years of their investments.

Traders who could not provide the years of their investments were excluded from the investment analysis. This led to a sample of 18 traders. Of the 18 traders, 13 are from Bamako, 3 traders are from Mopti, and 2 traders are from Koutiala. Of the 18 traders, 5 entered the cereals trade after the market reforms, 8 traders are from the core, and 6 of them rely on spot market transactions. This distribution of the 18 traders matches fairly well the distribution of the original sample of 55 traders.

Although the sample of 55 traders are representative of the population of traders in the three cities, the 18 traders retained for the analysis may not be representative of the population of traders of the tree cities. Thus, the results are subject to selection bias and

cannot be extrapolated to the whole population of traders in the three cities. However, the analysis does provide insight into the investment behavior of the selected traders.

4.3.1.2. Evolution of Net Investment in Warehouses and Trucking Capacity

The figures reported here are real net investment in warehouses and trucks of the sample of 18 traders. The nominal data were deflated by using the consumer price index (base 1980). The following formula was used to compute net investment (NI): NI = I_t - k * I_{t-1} where k represents the depreciation rate. The values of k used are the depreciation rates accepted by Malian tax authorities. These values are 4% for warehouses, and 10% for trucks.

Figure 4.1 Evolution of Real Net Investment of a Sample of Traders in Mali (1972-1989)
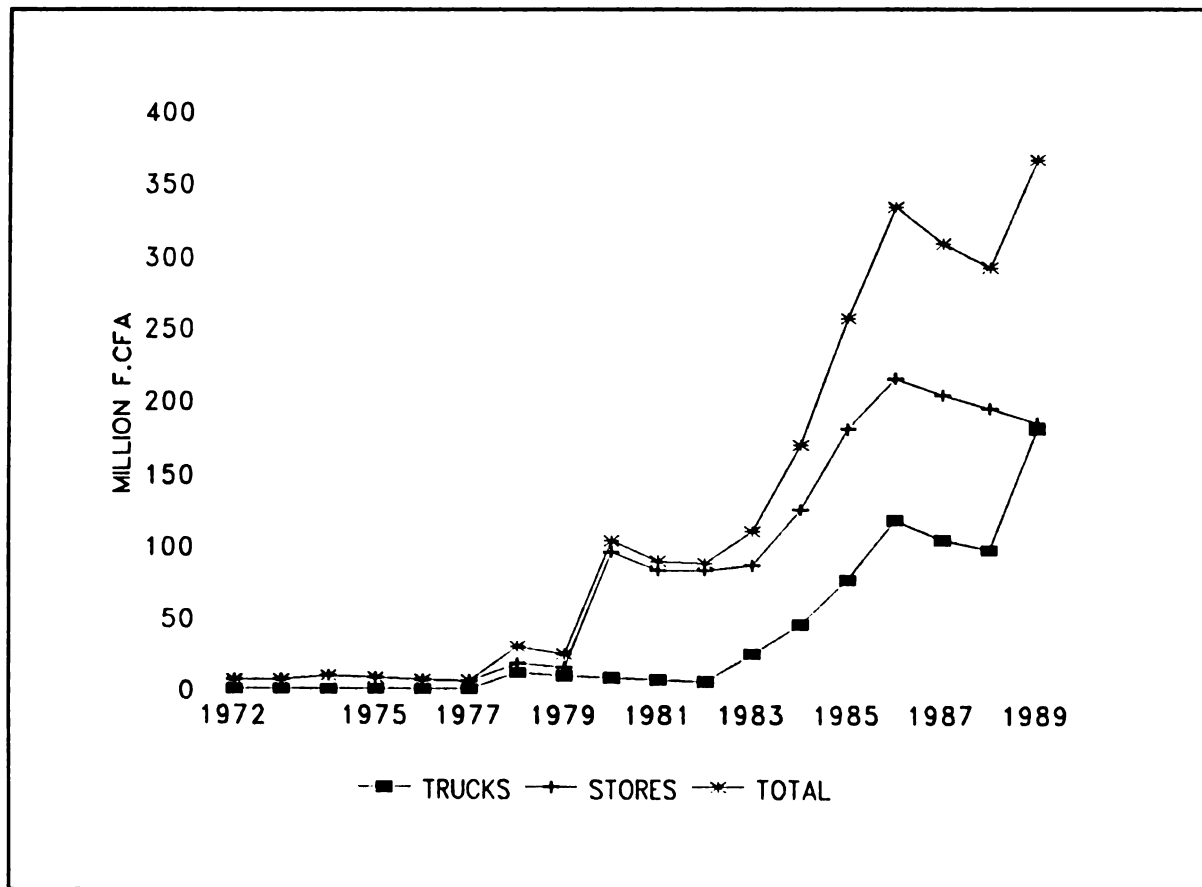
Source: CESA-MSU-AID field surveys (1990)

Figure 4.1 shows the evolution of real net investment in warehouses, real net investment in trucking capacity, and total real net investment over the period of 1972 to 1990. The evolution of real net investment in warehouses displays three distinct phases. Real net investment in warehouses stayed fairly constant at less than 20 million CFAF from 1972 to 1979. From 1980 to 1983, real net investment in warehouses jumped to a new level where it stayed constant until 1984. During the period of 1983 to 1986, real net investment in warehouses grew steadily and reached a new level, where it started to decline up to 1989.

Real net investment in storage capacity went from 96 million CFAF in 1980 to 185 million CFAF in 1989 (table 4.1). However, real net investment in warehouses grew faster (in percentage terms) during the pre-reforms period than during the post-reforms period. Real net investment in storage capacity grew by 40% per year from 1972 to 1980, and by 11% per year between 1981 and 1989 (table 4.1). The slowdown in the annual growth rate of real net investment in storage capacity after the market reforms may suggest that net investment in storage capacity is levelling off. Indeed, after reaching it highest level in 1985, real net investment in storage capacity by the sample of 18 traders fell slightly for the first time between 1987 and 1989.

Real net investment in trucking capacity started in 1978 and stayed constant until 1982. It rose rapidly from 1983 to 1986 and decreased slightly between 1986 and 1988 (figure 4.1). Real net investment in trucking capacity went from 8 million CFAF in 1980 to 181 million CFAF in 1989 (table 4.6). It declined by -19% per year before the market reforms, and grew by 42% per year after the market reforms in contrast to the evolution of net investment in warehouses (table 4.6).
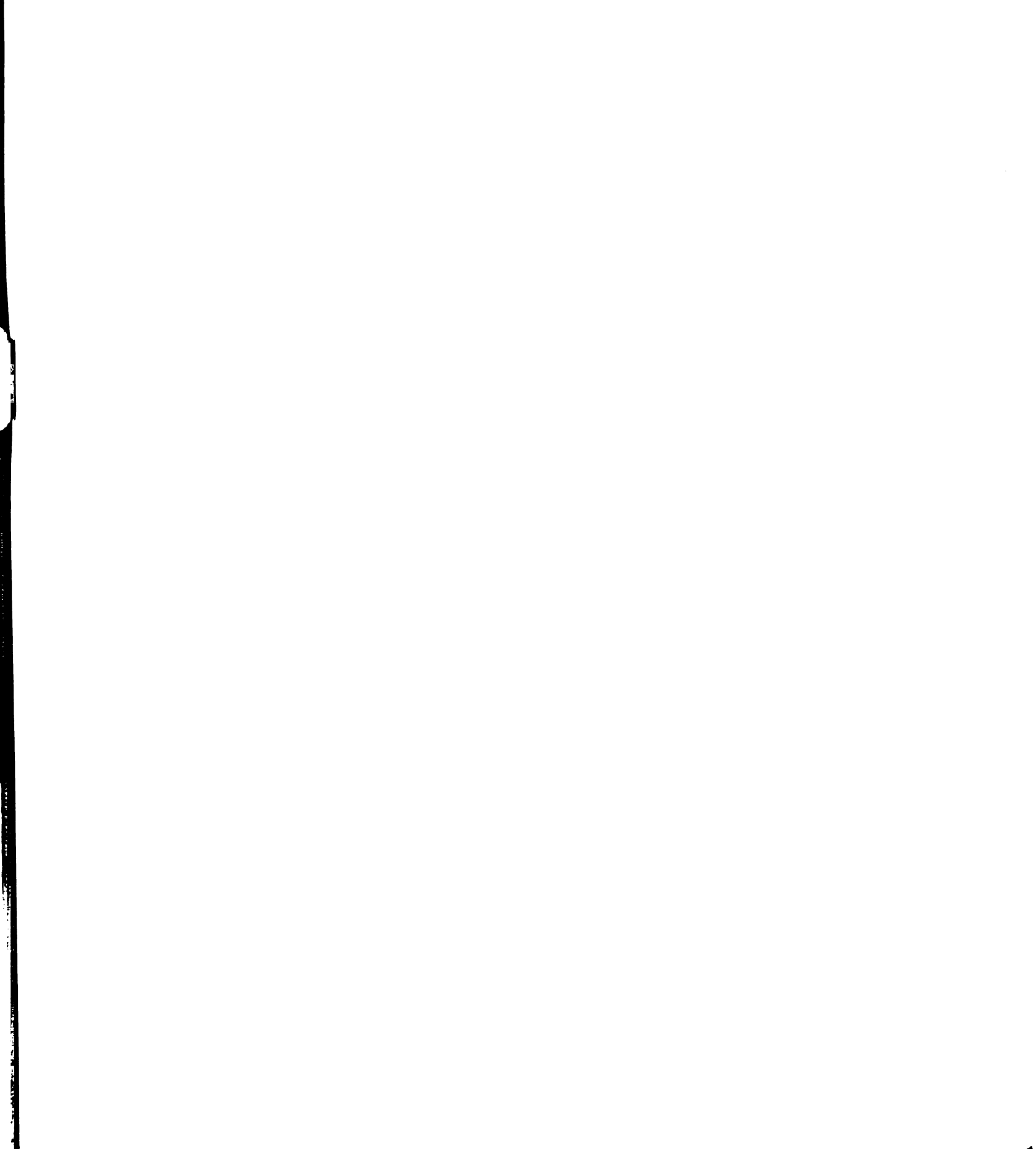
Table 4.6   Evolution of Real Net Investment

PERIOD	NET INVESTMENT (MILLION CFAF)	GROWTH RATE (%)
1972-80		
STORES	96	40%
TRUCKS[3]	8	-19%
TOTAL	104	42%
1981-89		
STORES	185	11%
TRUCKS	181	53%
TOTAL	366	19%

Sources: MSU-CESA-USAID, field surveys, 1990.

Total real net investment in storage and trucking capacity stagnated from 1972 to 1979 before increasing rapidly between 1980 and 1989. The growth of total net investment was especially strong between 1983 and 1989, with a decline in 1988 (see appendix II).

Total real net investment went from 104 million CFAF in 1980 to 366 million CFAF in 1989. However, it grew by 42% per year from 1972 to 1980 and by 19% per year from 1981 to 1989. Although the level of total real net investment is higher for the post-reform period than for the pre-reform period, total real net investment like net investment in storage capacity, grew faster (in percentage terms) before the market reforms than after the reforms. This may be explained by the fact that traders started from a low level of investment in 1972, while investment grew rapidly between 1978 and 1980.

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[3]   Net investment in trucks started in 1978. Therefore the growth rate of net investment in trucks was computed for three years during the period of 1972-80.

Table 4.7   **Variation of Real Net Investment Before and After the Market Reforms**

	TOTAL NET INVESTMENT (MILLION CFAF)		
PERIODS	AVERAGE	STANDARD DEVIATION	COEFFICIENT OF VARIATION (%)
1972-80	22	30	136%
1981-98	224	104	46%
t-statistics for difference of means = 5.6. N = 16.			

The t-statistics for difference of means supports the hypothesis that average net investment is higher for the post- reform period than for the pre-reform period at the 1% significance level (table 4.7). Thus, the market reforms appear to have induced increased investment in storage and trucking capacity among the sample traders. The most important finding is the fact that net investment has become more stable after the market reforms. Indeed, the coefficient of variation went from 136% to 46% after the market reforms (table 4.7).

4.3.1.3. Evolution of Real Net Investment by Groups of Traders

Although the market reforms have led to increased investment, it is more interesting for policy purposes to know which group of traders has invested the most. Four groups of traders are identified here. Total real net investment is divided between the core and the periphery, the evolution of net investment for each group is analyzed, and a test of mean difference is carried out.   Similarly, total real net investment is then divided between traders who use relational contracting as coordination mechanisms and traders who rely on spot market transactions, and the investment behavior of each group is analyzed with a test

of mean difference. Note that total real net investment is not divided between four groups, but between two groups at a time.

The distribution of real net investment in storage capacity between the periphery and the core shows that traders from the periphery made 93% of the total real net investment in warehouses before the market reforms, while traders from the core accounted for only 7% of the total (table 4.8). Real net investment in storage capacity grew by 39% per year within the periphery while it decreased by -13% per year within the core before the market reforms (table 4.8). After the market reforms, net investment in storage capacity grew by 36% within the core, while it grew only by 5% within the periphery (table 4.8). This suggests that the core was more constrained in its marketing activities than the periphery before the market reforms.

The distribution of real net investment in storage capacity between traders who transact through contractual arrangements and traders who rely on spot market transactions shows that traders with relational contracting invested more in storage capacity than traders who transact through spot market. Traders who adopted contractual arrangements accounted for 93% of the total real net investment in storage capacity before the market reforms (table 4.8). Real net investment in storage capacity grew by 39% per year for traders with relational contracting and fell by -13% for traders who rely on spot market transactions before the reforms (table 4.8).

Table 4.8   **Evolution of Net Real Investment by Categories of Traders**

PERIOD	STORES		TRUCKS			
	NET[1] INVET	(%)	NET INVET	(%)	TOTAL	(%)
1972-80						
PERIPHERY	89	39%	0	0	89	39%
CORE	7	-13%	8	-19%	15	-16%
SM[2]	7	-13%	8	-19%	15	-16%
RC[3]	89	39%	0	0	89	39%
1981-89						
PERIPHERY	116	5%	38	11%	154	9%
CORE	69	36%	143	49%	212	43%
SM	84	39%	127	46%	211	43%
RC	101	3%	54	18%	155	9%

1.   NET INVET refers to net investment in millions CFAF
2.   SM refers to traders who use spot market transactions as coordination mechanisms
3.   RC refers to traders who use relational contracting as coordination mechanisms

After the market reforms, traders who use spot market transaction as coordination mechanisms increased their share of total real net investment in storage capacity from 7% to 45%. From 1981 to 1989, real net investment in storage capacity grew by 39% per year for traders who use spot market transactions as coordination mechanisms, while it grew only by 3% per year for traders with relational contracting (table 4.8). Thus, traders who use spot market transactions as coordination mechanisms have invested faster than traders with relational contracting. This result suggests that the market reforms may have reduced the risk attached to spot market transactions. Indeed, prior to the market reforms, traders could not trade cereals in the open, and a trader needed a reliable partner who could pay and not denounce him to the government. With the reforms, open spot market transactions become legal and the risk of cereals seizure was removed.

Traders from the core and traders who rely on spot market transactions made all their investment in trucking capacity prior to the market reforms. After the market reforms, the same traders accounted for the bulk of total net investment in trucking capacity. For example, net investment in trucking capacity grew by 49% per year within the core, and by 11% per year within the periphery after the reforms. Real net investment in trucking capacity grew by 46% per year for traders who transact through spot market against 18% for traders with relational contracting.

The difference in investment strategy between the groups of traders may reflect the high policy-induced risk of attached to storage activities before the market reforms. Indeed, until recently, the government has been always suspicious of the storage activities of traders. During the poor crop year of 1984/85, government officials seized traders' grain stocks in the market despite the market reforms when prices went up. Thus, a trader would have to be of sufficient scale in order to bribe government officials or he would have to trade within

close networks to avoid stocks seizure.

The distribution of total real net investment between the sample traders from the periphery and those from the core after the market reforms shows that traders from the core account for 58% of the total. The same distribution of the total real net investment between traders who use spot market and traders with relational contracting also shows that traders who use spot market transactions as coordination mechanisms control 58% of the total real net investment. The interesting finding is that traders from the core and traders who rely on spot market transactions have the same share of total real net investment, while traders from the periphery and traders who use relational contracting have the same share.

Traders from the core and traders who use spot market transactions made between 60 and 67% of their total real net investment in trucking capacity, while traders from the periphery and those with relational contracting made between 65% and 75% of their total real net investment in storage capacity. The above findings suggest that traders who use spot market transactions are more likely to come from the core. Similarly, traders with relational contracting appear to come from the periphery. This lends additional support to the findings of chapter III that the structure of the marketing system comprises two distinct substructures referred to as the core and the periphery.

Table 4.9   Distribution of Real Net Investment Between Different Groups of Traders

PERIOD	TOTAL REAL NET INVESTMENT (MILLION CFAF)		
1981 - 1989	AVERAGE	STANDARD[3] DEVIATION	COEFFICIENT OF VARIATION (%)
PERIPHERY	135	42	31%
CORE	89	68	76%
t-statistics = -1.75, N = 16			
RC[1]	134	38	28%
SM[2]	90	71	79%
t-statistics = 1.64, N = 16			

1.   RC refers to traders who use relational contracting as coordination mechanisms.
2.   SM refers to traders who use spot market as coordination mechanisms
3.   The standard deviation measures changes from year to year in real net investment by the group.

Source: MSU-CESA-USAID, field surveys, 1990

Traders from the core achieved higher growth rate than traders from the periphery. This gives some support to the hypothesis that traders from the core are more likely to invest faster than traders from the periphery after the market reforms. However, the core had lower annual average total real net investment than the periphery during the post-reforms period (table 4.9). Moreover, real net investment by the periphery has been more stable than real net investment by the core (table 4.9). Note that the standard deviation for any group of traders measures changes from year to year in net investment. The test of mean difference between the two groups reveals that the periphery has higher annual average net investment than the core on after the market reforms. However, both the level and the growth rate of real net investment are higher for the core than for the periphery.

Traders with relational contracting achieved higher annual average net investment
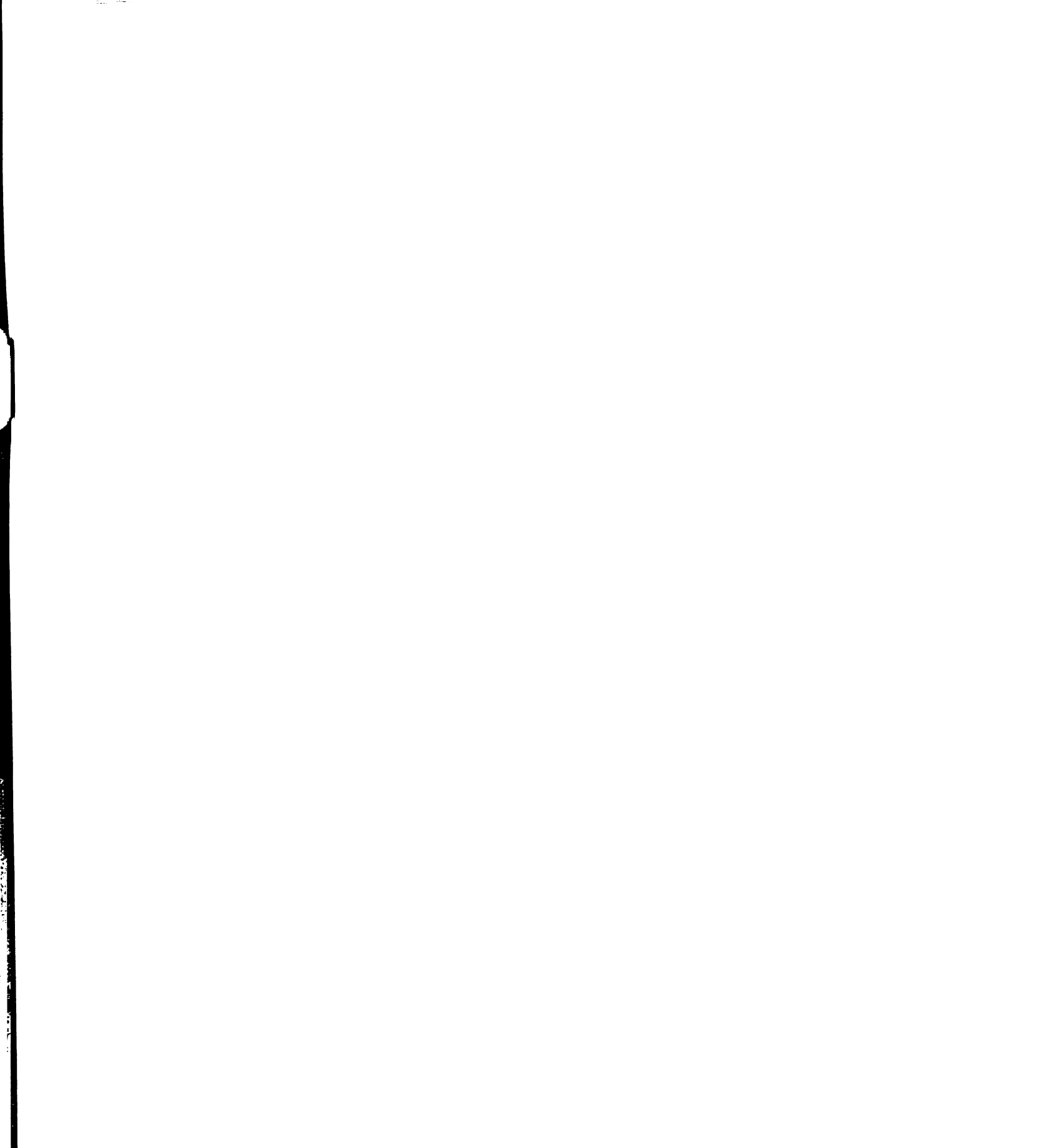
than traders who use spot market transactions as coordination mechanisms. In addition, real net investment has been more stable for traders with relational contracting than traders who use spot market transactions as coordination mechanisms. The test for mean difference at the 10% level supports that the hypothesis that traders with relational contracting have higher average investment than traders who use spot market transactions.

The stability of net investment within the periphery, where traders have more access to formal credit, than traders within the core, may suggest that the availability of formal credit affects more the stability of investment than its growth rate for the sample traders. Similarly, relational contracting seems to lead to more stable investment than to a higher growth rate for the sample traders. Thus, the statement by Kydd and Scaborough that traders may be constrained by lack of access to credit to expand investment is not supported by these findings for the sample traders. Indeed, the fact that the core has invested faster than the periphery after the market reforms both in storage and trucking capacity suggests that the elimination of policy-induced marketing risk may be more important than access to formal credit in inducing increased private investment in marketing infrastructure at a higher rate. In addition, the higher annual average net investment achieved by traders with relational contracting after the market reforms also suggests that coordination mechanisms that lead to increased permanent demand and reduced transaction costs are more likely to foster increased investment.

4.3.2. Evolution of Storage and Trucking Capacity and Employment Level

Storage capacity among the sample traders has increased dramatically since the market reforms of 1981. Total rented and owned storage capacity went from 895 tons during the period of 1972-80 to 8507 tons during the period of 1981-89 (table 4.10). This represents an increase of 7612 tons of capacity or a percentage increase of almost 850%. Average total

storage capacity also went from 61 tons during the period of 1972-80 to nearly 761 tons during the period of the reforms (table 4.10).

The most striking finding is the rapid increase in owned storage capacity after the market reforms. Total owned storage capacity among the sample traders went from 10 tons during the pre-reform period to 1937 tons after the reforms (table 4.10). This represents an increase of 1927 tons of owned storage capacity. This increase in capacity is in line with the increase in real net investment. Moreover, owned storage capacity that represented only 1% of total storage before the reforms accounted for almost 23% of total storage capacity between 1981 and 1989. Thus, the trend in the marketing system seems to be a shift away from rented storage capacity to owned storage capacity.

The increase in owned storage capacity may reflect a growing confidence of traders in the permanence of the market reforms on the one hand, and an improvement in incentives brought about by the overall liberalization of economic activities in 1980 under the requirements of the structural adjustments on the other hand. Moreover, the fact that investment in storage capacity has grown for all groups of traders after the market reforms suggests that the increase in owned storage capacity was probably financed out of retained earnings. Indeed, Metha (1989) and Steffen (1992) found that urban traders tend to own more storage capacity than wholesale assemblers from producing zones and that urban cereals trade appears to be more concentrated than wholesale assembly. Thus, the increased profits that may have resulted from concentration of urban cereals trade appear to have been re-invested in marketing facilities.

Total trucking capacity among the sample traders during the pre-reform period was 25 tons. This capacity increased to 40 tons after the market reforms. Thus, the gain in trucking capacity was 15 tons or 62.5 percent increase after the market reforms. However,

trucking capacity has increased less rapidly than owned storage capacity. This may suggest that other constraints outside the cereals subsector are constraining traders' ability to investment in trucking capacity. Trucking rates were heavily regulated and controlled in Mali until 1988, when trucking rates for freight were deregulated. Moreover, the national cooperative of transporters is a very strong organization that restricts entry into the trucking business through the control and allocation of freight between transporters in major Malian cities. These two factors among other things are important obstacles to the growth of investment in trucking capacity, or it may be that it has simply remained cheaper to rent trucking services given the seasonality of the grain trade.

The fact that storage and trucking capacity among the sample traders went up after the market reforms suggest that the grain trade is building its own capital stock. This shift away from borrowed capital stock to owned capital stock does not support the proposition by Chataigner that grain trade in West Africa may be dependent on borrowed capital. However, the proposition may correspond to the reality of the pre-reform period in West Africa, during which grain trade was under governmental control. Thus, the reliance of traders on borrowed capital may reflect the risk attached to grain trade. With the market reforms, policy-induced risk of grain trade will diminish and traders' confidence in the permanence of these reforms may move the grain trade away from borrowed capital to owned capital.

Table 4.10   Evolution of Storage Capacity, Trucking Capacity, and Employment Level

Period	Storage Capacity (Tons)			Trucking Capacity (Tons)	Employment
	Rented	Owned	Total		
1972-80	885	10	895	25	20
1981-90	6570	1937	8507	40	107

Source: CESA-MSU-USAID field survey data (1990)

Total employment increased after the cereals market reforms of 1981. The sample traders employed a total of 20 persons during the period of 1972 to 1980, with an annual average of 2 employees. This figure jumped to 107 persons between 1981 and 1989. This give an annual average of about 12 employees for the post reforms period. Thus, total employment grew by 87 employees after the market reforms of 1981 for the sample traders.

Data from Mehta (1989) indicate that 45 wholesale assemblers and wholesalers entered the cereals trade after the market reforms in Koutiala, Sikasso, Mopti, and Bamako. Moreover, Camara and Monette (1992) report that the number of traders whose first activity has become cereals trading after the market reforms of 1981, has increased fivefold in the regions of Kayes and Koulikoro. With a sample size of 412 wholesale assemblers and wholesalers surveyed by Camara and Monette, the number of wholesale assemblers and wholesalers who entered the cereals trade after the reforms of 1981 can be estimated at 4/5 of 412 or 330 people.

Although there is no data available on the total number of jobs created by the market reforms, the number of new entrants in the cereals trade found by Mehta and Camara and Monette, combined with the increases in employment by established traders noted here, suggest that the loss of the 801 jobs that resulted from the reforms of OPAM may have been gained back in the private sector. Indeed, many people entered the cereals

trade at the rural assembly level and at the retail level where no study has been carried out. For example, the FAO survey found that 1,422 people were self employed at different levels in the cereals subsector in 1992.   The jobs created in the private sector after the reforms involve mainly low skills compared to the high skills jobs lost by OPAM. Thus, the market reforms appear to have replaced high skilled workers with low skilled workers. This substitution is a net gain because of the scarcity of high skills workers in most African countries. Therefore, one of the most important benefits of economic reforms under the structural adjustment programs in Africa may turn out to be an increase in the supply of highly skilled workers as well trained workers are released from the state bureaucracies.

CHAPTER V

5. Choice of Coordination Mechanisms and its

Relationship to Storage and Cereals Exports

The governance structures available to traders to manage their interdependence, referred to here as coordination mechanisms, include spot-market transactions, different contractual arrangements, and vertical integration by ownership. Although it was shown in chapter IV that the use of contractual arrangements may be related to higher annual average investment and more stable investment than spot market transactions, the questions remain: What determines traders' choice of contractual arrangements? Do traders have the necessary incentives and ability to adopt contractual arrangements? How does traders' choice of contractual arrangements affect their storage and cereals exports practices? This chapter addresses these questions.

5.1 Determinants of Traders' Choice of Coordination Mechanisms

Traditionally, agricultural marketing research has been concerned with the incentive aspects of transactors' choice of coordination mechanisms. For example, Purcell argues that interstage coordination will be forthcoming if a transactor can derive some economic gains from the adoption of coordination mechanisms. These gains include reduced cost, increased profits, stable profit stream and a reliable supply of raw material. Marion (1986) has stressed the role of contract in reducing market and price uncertainties as one of the main motives for contractual arrangements.

Transaction-cost economics proposes that choice among alternative coordination mechanisms is related to their transaction-cost differentials. The nature and the level of these costs are influenced by the attributes of the transactions such as uncertainty, asset specificity, and the physical properties of the goods being exchanged. In agriculture,

perishability, strategic delay, site or location specificity, uncertainty, and product heterogeneity are the major determinants of organizational form in agricultural transactions (Masten, 1991). However, too much emphasis on the attributes of transactions has led transaction-cost theory to pay less attention to supply factors that may constrain transactors' choice of alternative coordination mechanisms.

5.1.1 Empirical Application of Transaction-cost Theory

The empirical model implied by transaction-cost propositions can be stated as follows (Masten, 1991):

$$G^* = G^1, \text{ if } C^1 < C^2, \text{ and}$$

$$= G^2, \text{ if } C^2 < C^1$$

where G^1 and G^2 represent alternative coordination mechanisms, G^* the coordination mechanism chosen, and C^1 and C^2 the costs associated with G^1 and G^2 respectively.

The costs associated with G^1 and G^2 are hypothesized to be influenced by a set of exogenous attributes of the transactions under consideration. Thus, these costs can represented by the following equations:

$$5.1 \qquad C^1 = aX + e, \text{ and}$$

$$5.2 \qquad C^2 = bX + u,$$

where X represents a vector of the exogenous attributes, a and b represent vectors of coefficients, and e and u represent the error terms. The hypotheses that relate the exogenous attributes to C^1 and C^2 can be tested by estimating equation 5.1 and equation 5.2. However, C^1 and C^2 cannot be empirically observed (Masten, 1991). Indeed, transaction-cost differentials among alternative coordination mechanisms cannot be observed because the costs associated with alternative mechanisms not chosen cannot be observed. For example, once a firm has chosen vertical integration by ownership, the costs associated with

relational contracting for that firm cannot be observed. Thus, researchers cannot measure the transaction-cost differentials between vertical integration by ownership and relational contracting for this particular firm.

To address these measurement problems, researchers have used discrete choice models to test empirically transaction-cost propositions. The central presumption is that the transactor has preferences over alternative coordination mechanisms, and that the transactor will choose the alternative that minimizes the most transaction costs. For example, with G^1 and G^2 as alternative coordination mechanisms, the choice of the transactor can be modelled and estimated as follows: the probability that G^1 will be chosen equals $Pr(C^1 < C^2) = Pr(aX + e < bX + u) = Pr(e-u < (b-a)X)$. The hypotheses that relate the exogenous attributes X to C^1 and C^2 are tested by the predicted sign of the coefficients b-a (Masten, 1991).

5.1.2 Discrete Choice Model of Traders' Adoption of Coordination Mechanisms

Empirical tests of transaction-cost propositions have paid little attention to transactors' ability to adopt alternative coordination mechanisms. However, when coordination mechanisms are viewed as organizational technologies, their adoption depends both on the expected returns as related to the attributes of transactions and the resources available to transactors. These resources include both physical and human resources. For example, Egan and Mody (1992) argue that the collection of specialized industry information on product requirements and production techniques necessary to establish buyer-seller links in export markets is too costly for many developing-country firms. Moreover, these firms lack the know-how to meet international market specifications and quality standards.

The statement by Egan and Mody implies that other socio-economic characteristics of traders, besides the attributes of cereals transactions, affect traders' ability to adopt alternative coordination mechanisms. For example, difference in ability to manage

marketing risk between traders creates differences in the way in which these traders adapt the terms of payment and delivery of relational contracting to circumstances as they arise. However, the way in which the terms of payment and delivery are adapted to circumstances defines different types of relational contracting. Thus, two different coordination mechanisms may have different requirements in terms of other socio-economic factors such as scale of operations even though they may be equally attractive to traders.

The Model

The model to be estimated below extends the empirical discrete choice model implied by transaction-cost propositions. The model assumes that the observed exogenous socio-economic characteristics of grain traders and the attributes of cereals are causal variables affecting the choice of alternative coordination mechanisms, in contrast to the usual approach of transaction-cost theory where only the attributes of the transactions are causal variables. The relevance of the socio-economic characteristics of traders to the choice process can be assessed by testing the null hypothesis that the coefficients for the socio-economic characteristics are equal to zero.

In chapter II and IV, it was shown that the existing structure of domestic supply and demand, and the physical and institutional setting restrict the range of alternative coordination mechanisms to spot market transactions (SM) and informal contractual arrangements (RC). As a result, only the choice between these two alternative coordination mechanisms to acquire supplies and to sell cereals is examined. Thus, the choice of alternative coordination mechanisms is analyzed on both sides of the transaction for wholesale assemblers and urban wholesalers.

Suppose a rural wholesale assembler's or urban wholesaler's revenue, R, depends on c_i, the transaction costs associated with alternative coordination mechanism i. Thus, the revenue function of the trader can be represented by $R_i = R(c_i) + \epsilon_i$, where ϵ_i represents the error term. Let i take the value of one when a rural wholesale assembler or an urban wholesaler adopt contractual arrangements (RC) and the value of zero when a rural assembler or an urban wholesaler does not adopts RC. According to transaction-cost theory, a rural wholesale assembler or an urban wholesaler will adopt RC if

(5.3) $R(c_1) + \epsilon_1 - R(c_0) - \epsilon_0 > 0$

where, c_1 and c_0 represent the transaction costs associated with RC and SM (spot-market) respectively, and are a function of certain exogenous attributes of cereals transactions.

Although the revenue difference between RC and SM determined by the attributes of cereals transactions may be positive, traders must be able to choose RC. This ability to chose does not depend on the attributes of cereals transactions, but on the socio-economic characteristics of traders. As a result, both the attributes of cereals transactions and the socio-economic characteristics of traders determine the observed choices of alternative coordination mechanism.

The choice between RC and SM cannot be predicted by estimating directly their revenue differential because their associated transaction costs c_1 and c_0 are not easily measured. However, the attributes of cereals transactions, which determine c_1 and c_0, and the socio-economic characteristics of traders, which influence the process of choice, can be observed and measured by proxies. Thus, the process can be modelled by assuming that the choice between RC and SM is a linear function of the attributes of cereals transactions and the socio-economic characteristics of traders.

Suppose x represents a vector of cereals transaction attributes and socio-economic characteristics that influence c_i and the choice observed. Thus, the choice problem can be represented by

$$Y^* = R(c_1) + \epsilon_1 - R(c_0) - \epsilon_0$$

$$= a_0 + a_1x + \epsilon_1 - b_0 + b_1x - \epsilon_0$$

$$= (a_0 - b_0) + (a_1 - b_1)x + (\epsilon_1 - \epsilon_0).$$

Let $\alpha = (a_0 - b_0)$, $\beta = (a_1 - b_1)$ and $v_i = (\epsilon_0 - \epsilon_1)$. Then, the revenue differential can be written as

$$Y^* = \alpha + \beta x - v_i,$$ where α and β are parameters to be estimated. Let Y_i represent the finite set of the two mutually exclusive choices that takes the value of 1 when RC is observed, and the value of zero when SM is observed. Thus, the probability that a rural wholesale assembler or an urban wholesaler will adopt RC, given x, is

$$(5.4) \quad Pr(Y_i = 1|x) = Pr(Y^* > 0)$$

$$= Pr[(\alpha + \beta x - v_i) > 0]$$

$$= Pr(v_i < \alpha + \beta x)$$

Alternatively, the probability that a rural assembler or an urban wholesaler will not adopt RC or will adopt SM is

$$(5.5) \quad Pr(Y_i = 0|x) = Pr(v_i > \alpha + \beta x)$$

$$= 1 - Pr(Y_i = 1|x)$$

$$= 1 - Pr(v_i < \alpha + \beta x).$$

Let $P_i = Pr(Y_i = 1|x)$. Then, $Pr(Y_i = 0|x) = 1 - P_i$.   Thus, the probability of

observing choice Y_i, whether it be 1 (RC) or 0 (SM), is given by

$P_i^{Y_i}(1-P_i)^{1-Y_i}$. Thus, the probability of

observing any sample of N values of Y_i, given N observed values of x, is

$$(5.6) \qquad P(Y|x) = \prod_{i,1}^{N} P_1^{Y_i}(1-Y_i)^{1-Y_i}$$

Because P_i depends on the values of α and β, $P_i^{Y_i}(1-P_i)^{1-Y_i}$, also depends on α and

β. Thus, α and β can be estimated by setting and maximizing the following log-likehood

function for the N independent observations

$$(5.7) \quad logL(Y|x,\alpha,\beta) = \sum_{i=1}^{N}[Y_i logP_i + (1-Y_i)log(1-P_i)],$$

where N is the number of observations, Y_i equals 1 if a trader adopted RC, and Y_i equals

zero if the trader adopted SM.

Hypotheses

Three socio-economic characteristics of traders and two attributes of cereals

transactions are hypothesized to influence the adoption of contractual arrangements.

Experience in cereals trading, scale of operation, and the practice of credit needs planning

are the socio-economic characteristics that affect the ability of traders to adopt contractual

arrangements.   The two attributes of cereals transactions are spatial distribution of

transactions and asset-specificity as measured by the degree of specialization in cereals

trade. The study assumes that these five factors affect the choice of contractual arrange-

ments for both supplies acquisition and cereals sale.

Hypothesis 1: Traders with long experience are more likely than traders with less

experience to adopt contractual arrangements.

Experienced and established grain traders have credit history and records of

reputation compared to new entrants. Therefore, the costs of collecting information on the creditworthiness and reliability of experienced traders are lower than the costs of gathering the same information on new entrants. Because established grain traders belong to networks of trading relationships where information on the creditworthiness of fellow traders is available and shared, they have lower costs associated with contractual arrangements than new entrants.

Hypothesis 2: Large scale increases the likelihood of a trader adopting contractual arrangement.

Although experienced traders are likely to adopt contractual arrangements, the costs associated with contracting can only be amortized over large volume of repeated transactions. Thus, the scale of operation is a relevant factor specifically for wholesale assemblers. Indeed, a wholesale assembler must reach some adequate size in order to take advantage of long-distance trade given transportation and the transaction costs involved. Similarly, an urban wholesaler must be of adequate size before he can attract large suppliers from producing zones.

Hypothesis 3: Increases in the number of years of the practice of credit needs planning by a trader increases his likelihood of adoption of contractual arrangements.

For wholesale assemblers to be able to make timely delivery of large volume of grain and to extend credit to clients in urban centers, they must be able to mobilize the necessary credit. Therefore, wholesale assemblers must be able to assess and to plan adequately their credit needs. Similarly, urban wholesalers need to identify potential sources of short-term credit which can be called upon to meet payment obligations when they fall short of cash. Thus, urban wholesalers must also plan their credit needs to cover temporary shortfalls in
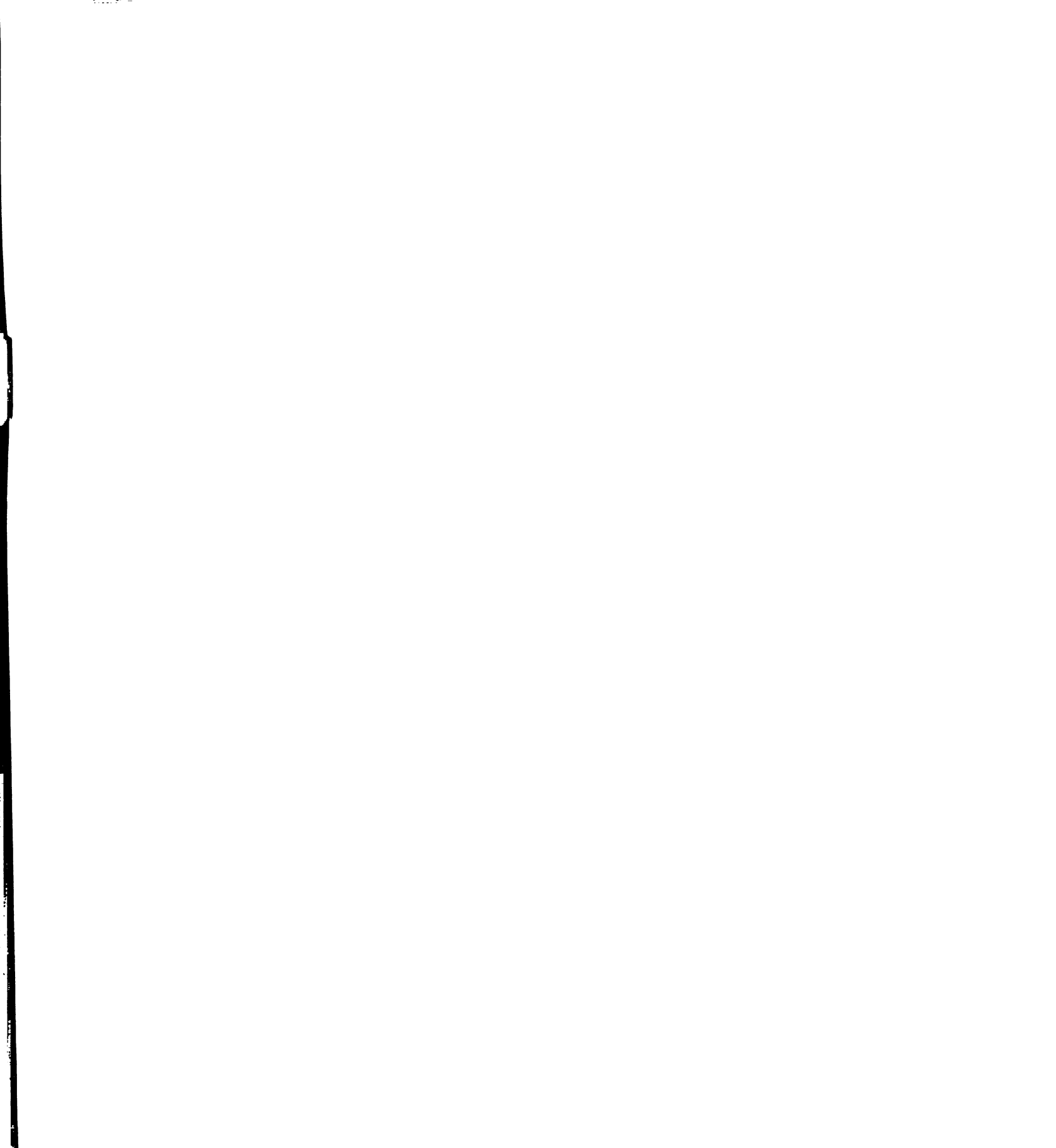
revenue.

Hypothesis 4: Wholesale assemblers from producing zones are more likely than urban wholesalers to adopt contractual arrangements for cereals sale.

Spatial distribution of transactions refers to the geographical distances that must be covered to reach the points of sales for wholesale assemblers and the points of supplies for urban wholesalers. Spatial distribution of cereals transactions is subject to behavioral uncertainty. Behavioral uncertainty arises mainly from a lack of freely available information on the creditworthiness of fellow transactors in the trading community. However, traders need to assure themselves that their clients have good credit histories, and that their suppliers are reliable and able to make timely delivery.

Because they pre-finance most of the grain assembly and transportation to urban centers and must extend credit to urban wholesalers, wholesale assemblers need information on the credit histories of potential urban clients to determine whether long-term relationships can be sustained. Similarly, urban wholesalers need information on the ability and reliability of potential suppliers from producing zones to make regular timely delivery. By dealing with only a small number of reliable and large suppliers, an urban wholesaler avoids the costs and quality variability associated with multiple sources of supply.

Most wholesale assemblers transport their grain for sale in urban centers (Dembélé et al., 1986; Metha, 1989). As a result, a wholesale assembler faces two types of costs: the costs associated with the search for clients and the costs of supporting himself in urban centers. The longer the stay in the urban center, the higher these costs for a wholesale assembler. In contrast, most urban wholesalers get their supplies in the same market where they reside. Therefore, urban wholesalers do not face the additional costs of stay in urban centers. Moreover, urban wholesalers face lower search costs because they have easy access
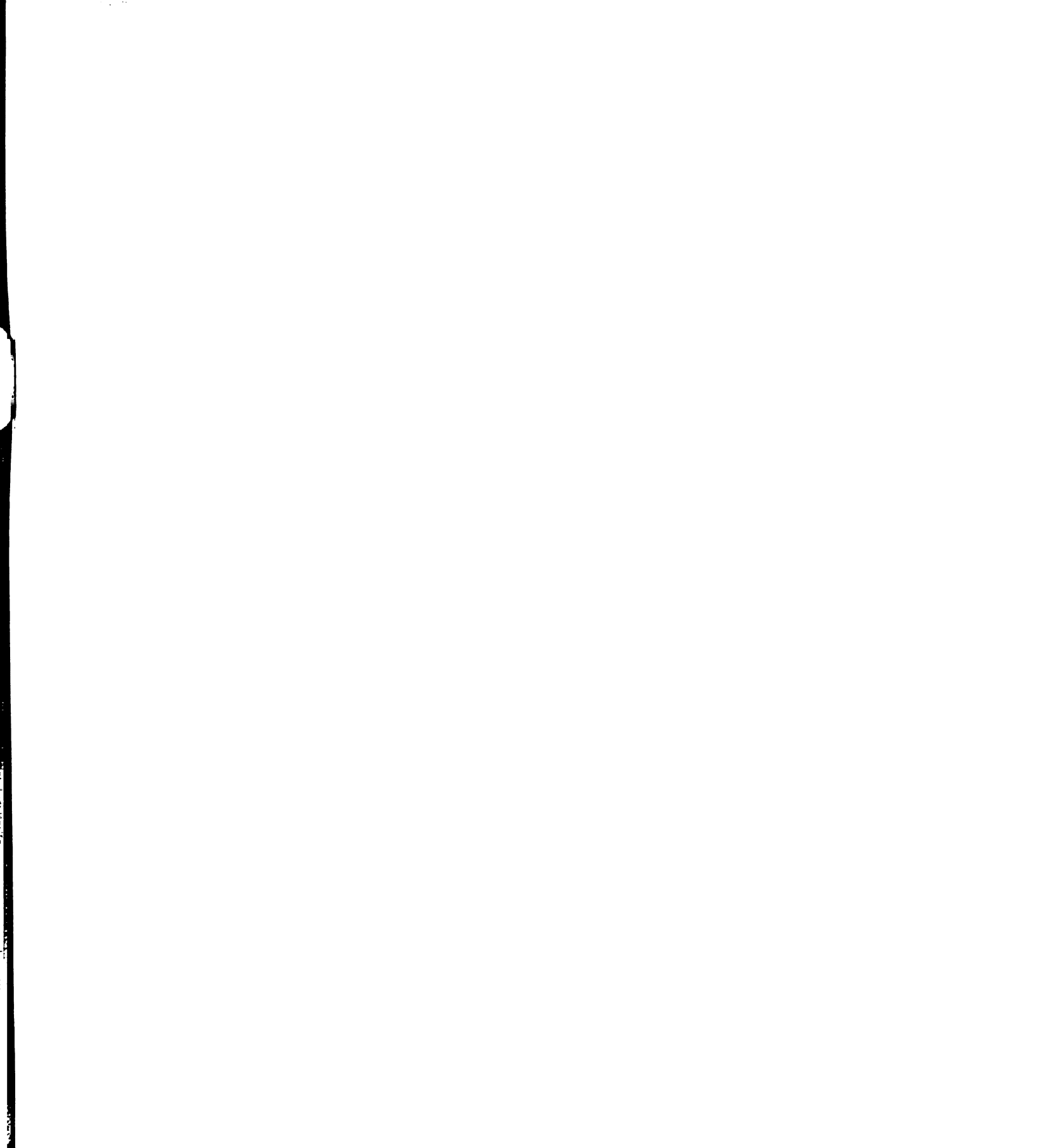
to information on supply locations in urban centers compared to wholesale assemblers, who

may lack information on potential buyers in urban centers.

When a wholesale assembler uses spot market transactions, he must be willing to

stay longer in urban centers the larger his grain stock and the more variable the prices.

Therefore, the costs associated with spot market transactions in urban centers are likely to

be higher for wholesale assemblers than urban wholesalers.

Hypothesis 5: Specialized traders are more likely than no-specialized or diversified

traders to adopt contractual arrangements.

Traders who depend on cereals trading for their living earn quasi-rents because of

lack of alternative employment opportunities or other goods they can trade. These are non-

diversified traders who need to stabilize their income stream through stable trading

relationships that assure regular supplies and sales at any time.

Description of Variables

The variables used to estimate the empirical model are the following: Two equations

are estimated, one for contracting of supplies and one for contracting of sales. The

observed choices of contractual arrangements are the dependent variables: FRC takes the

value of one when a trader acquires half and more of his supplies from regular suppliers and

the value of zero otherwise. CRC takes the value of one when a trader makes half and

more of his cereals sales through regular clients and zero otherwise.

The independent variables are:

(a) Experience (DUREX) is a dummy variables that takes the value of one when a

wholesale assembler or an urban wholesaler has entered the cereals trade before the market

reforms of 1981, and the value of zero when a wholesale assembler or an urban wholesaler

entered the cereals trade after the reforms of 1981.

(b) Number of years of credit needs planning practice (ACR) measures the number of years during which a wholesale assembler or an urban wholesaler has been planning his credit needs at the beginning of each marketing year.

(c) Specialization (SPECIA) is a dummy variable that measures the degree of non-diversification in cereals trade. SPECIA takes the value of one when a wholesale assembler or an urban wholesaler sells only cereals and the value of zero when a wholesale assembler or an urban wholesaler is diversified (engaged in other trading activities other than cereals transactions). This variable measures the degree of asset specificity of a trader.

(d) The average monthly cereals sales in 1989 (SCAL) describes the scale of operation of a trader.

(e) The spatial distribution of transactions is described by two dummy variables. These variables capture also the locational effects on the choice process. BAM is a dummy variable that takes the value of one when an urban wholesaler is from Bamako, and the value of zero otherwise. MOPT is a dummy variable that takes the value of zero when an urban wholesaler is from Mopti, and the value of zero otherwise. Note that there is no need to define another dummy variable for wholesale assemblers from Koutiala because the effect of being a wholesale assembler from Koutiala can be computed by setting the coefficients for BAM and MOPT to zero.

(f) FRC is a dummy variable that takes the value of one when a trader acquires more than half of his total supplies through contractual arrangements and the value of zero otherwise. CRC is a dummy variable that takes the value of one when a trader sells more than half through contractual arrangements with clients and the value of zero otherwise.

The empirical probit equation used to test the effects of the five factors have on the probability of a trader adopting FRC or CRC is :

5.8 $\log L(P_i | x, \alpha, \beta) = \prod_{y_{ij}=0} \Phi(-\beta x) \prod_{y_{ij}=1} [1 - \Phi(-\beta x)]$,

where, in the equation:

$\beta x = \beta_0 + \beta_1 DUREX + \beta_2 ACR + \beta_3 Sales + \beta_4 SPECIA + \beta_5 BAM + \beta_6 MOPT$

Following Maddala (1983), the marginal probability associated with a change in a continuous explanatory variable x_{ij} is computed by taking the partial derivative of equation 5.7:

(5.8) $\dfrac{\partial P_i}{\partial x_{ij}} = \phi(x_i \beta) \beta_j$

The effect of a discrete variable x_{ij} on the probability of a trader adopting CRC or FRC is the difference in the probability with and without the variable and is given by the following expression:

(5.9) $P_i(|x_{ij} = 1) - P_i(|x_{ij} = 0)$.

5.1.3 Empirical results

Table 5.1 below presents the estimates of the parameters of the empirical model. The F-statistic was computed by dividing the Chi-Square generated by the Limdep subroutine by the number of independent variables (see Aldrich and Nelson, 1985). The F-statistic indicates that the estimated model is significant at the 1% level for contractual arrangements with clients (CRC), but gives a poor fit for contractual arrangements with suppliers (FRC).

The coefficient for DUREX is positive as expected for both FRC and CRC, but significant only at the 1% level for CRC. This indicates that traders who entered the cereals

trade before the market reforms are more likely to have regular clients than traders who entered after the reforms. However, experience seems to be less important in explaining adoption of contractual arrangements with suppliers.

The coefficients for Bamako and Mopti are negative in both equations. The coefficients are significant in the CRC equation, while the coefficient for Bamako is significant in the FRC equation. These results indicate that traders from producing zones (wholesale assemblers) are more likely than urban wholesalers to engage in contractual arrangements for both supplies acquisition and cereals sales. Thus, the costs associated with spot market transactions appear to be higher for wholesale assemblers than for urban wholesalers. Moreover, the diversity of sources of supplies in urban centers may also explain why urban wholesalers are less likely to engage in contractual arrangements for supplies acquisition.

The coefficient for managerial ability is positive as expected in both equations, but significant only for FRC. Indeed, the estimated coefficient is positive as expected and significant at the 10% level. Thus, managerial ability as measured by the practice of credit needs planning (business planning) is positively correlated with the likelihood of a trader adopting contractual arrangements with suppliers. This result indicates that the development of managerial skills within the cereals subsector should improve stable contractual arrangements between wholesale assembly and urban wholesaling on the one hand, and between urban wholesalers and exporters, semi-wholesalers, and retailers on the other hand.

The coefficient for SPECIA, the degree of specialization in cereals trade is positive as expected and significant for both FRC and CRC. Thus, the more a trader is dependent on cereals trade for his living, the more likely he is to adopt contractual arrangements with his suppliers and clients. This result indicates that the more specialized traders become, the

more vertical coordination would improve in the cereals subsector (see Marion, 1985).

Table 5.1   Estimated Coefficients for the Probit Regression

Variable	Contract with Suppliers (FRC)	Contract with Clients (CRC)
Durex	0.2825	1.8636*
	(-0.691)	(2.914)
Mopt	-0.5626	-3.5967*
	(-0.991)	(-3.842)
Bam	-1.0713***	-1.8156**
	(-1.775)	(-2.249)
Acr	0.5324	0.1095
	(1.610)***	(0.372)
Scal	0.6693	-0.1022
	(0.760)	(-0.903)
Specia	1.0325*	0.9248***
	(2.391)	(1.808)
Constant	-0.5043	0.1260
	(-0.119)	(0.260)
F-(6,49)	1.64	5.46
	N = 55	N = 55

Note: Numbers in parentheses are t-statistics.
Single asterisk means significant at the 1% level,
double asterisk means significant at the 5% level,
and triple asterisk means significant at the 10%.

The coefficient for SCAL is positive as expected in the FRC equation, but not significant. The coefficient is negative in the CRC equation contrary to expectations. However, it should be noted that the average monthly sales figure of one year may be a poor proxy for scale, which could be better measured by a monthly sales average over many years. The positive sign in the FRC equation does suggest that a trader is likely to engage in contractual arrangements for supplies acquisition when he has achieved a certain scale of operations.

Table 5.2   **Marginal Probabilities Associated with ACR and SCAL**

Variable	Adoption probability of contracts with:	
	Suppliers	Clients
Managerial ability (ACR)	0.20	0.42
Scale of operations (scal)	0.26	-0.39

Table 5.2 presents the marginal probabilities of adopting contractual arrangements associated with a unit change in the independent variable ACR and SCAL. These marginal probabilities were computed by setting the independent variables at their average values. The results indicate that increasing the number of years of the practice of credit needs planning by one year increases the probability of adopting contractual arrangements with suppliers by 20%. Thus, increasing managerial ability has a bigger effect on the likelihood of traders adopting contractual arrangements with their suppliers.

Although the marginal probabilities associated with the scale of operations are not statistically significant, they are positive for the adoption of contractual arrangements with suppliers and negative for adoption of contractual arrangements with clients. The negative marginal probabilities of adoption of contractual arrangements with clients associated with increases in the scale of operations can be explained by the move from the core to the periphery. Indeed, the core uses informal contractual arrangements based on diffuse relationships to manage marketing risk, as most of its members are too small in scale to spread such risk over different activities. In contrast, large-scale traders from the periphery can manage their marketing risk through diversification, and thus escape the social obligations attached to informal contractual arrangements such as helping fellow traders

during difficult times.

The use of contractual arrangements with clients appears to be a risk management tool used by the small-scale trade where experience, specialization in cereals trade, and managerial ability acquired over time drive the adoption of such contractual arrangements. In contrast, the large-scale trade manages risk through diversification and uses contractual arrangements to stabilize its sources of supplies where specialization in grain trade drives the adoption of such contractual arrangements. Therefore, large-scale and diversified traders appear to rely on the spot market for most of their transactions. Thus, the interesting question which merits further investigation is whether or not the transaction costs of spot markets are far less than the transaction costs and the social costs associated with informal contracting in the cereals trade.

5.2 Determinants of Traders' Investment in storage and cereals exports

The adequacy of incentives and the availability of financial resources determine to a great extent traders' investment in storage and cereals exports. Storage activities consume real resources. The opportunity cost of capital invested and the risk associated with adverse price variation constitute the main elements of storage cost. All of these cost elements must be recovered by price increases over time to induce traders to undertake storage activities. Therefore, the private sector will store cereals if the expected gain from later sale equals or exceeds the storage cost. Similarly, export opportunities and positive returns must exist before the private sector can engage in large-scale cereals exports during surplus production years.

5.2.1 Returns to storage activities

The failure of the credit programs to encourage commercial storage has raised the issue of the adequacy of returns to and the risk attached to investment in cereal stock in the

Malian context. According to Mehta (1989), returns to storage activities for millet are erratic and unpredictable, especially for long periods, and traders act rationally by not engaging in long-term storage. For example, findings by Mehta (1989) indicate negative net returns to storage for wholesalers in Bamako and Mopti at both 30% and 18% of opportunity cost of capital when grain was bought in November 1985 and sold in March 1986. However, the findings by Mehta relate to a single crop year.

Following Goetz and Weber (1986), table 5.3 presents the probabilities of storage profits and losses over a period of 12 years from 1981 to 1992 for millet in Bamako. The probabilities were computed by assuming that traders acquire their grain stock in January of each year, with an annual physical loss rate of 3%. With an opportunity cost of capital of 30%, which corresponds to the annual interest on informal loans (Dembélé et al., 1986; Mehta, 1989), the probabilities of storage losses are 75% when traders sell in April and 58% when they sell in May. Traders who sold off their stock between June and October of each year during the period lost money once every two years.

With an opportunity cost of capital of 12%, the probabilities of storage losses are 50% when traders sell in April and 42% when they sell in May. The probabilities for positive returns on storage are 75% for the months of June and July, and 67% for September and October. These results indicate that the best strategy for traders would be to acquire stocks during the month of January and to sell between June and July.

Table 5.3 Probabilities of storage losses on millet purchased in January. Period: 1981-92

Month of sale	Opportunity Cost of Capital	
	Formal Credit: 12%	Informal Credit: 30%
April	0.50	0.75
May	0.42	0.58
June	0.33	0.50
July	0.25	0.50
August	0.25	0.50
September	0.33	0.50
October	0.33	0.50

Source: Price Data from SIM and Direction Nationale de la Statistique (DNSI)

In fact, January corresponds to the period of harvest, when producer prices reach their lowest level, and the months of June and July correspond to a period when most producers are uncertain about the rainfall pattern of the coming season and hold onto their grain reserves.

The months of August and September are the months during which the rainfall pattern of the coming season has been established. When producers are optimistic about the coming season, they release their old stocks onto the market and price tends to fall. In contrast, when producers are pessimistic, they retain their stocks and price rises. Thus, the months of June and July present less risk to traders who store grain, while the months of August and September may offer high returns at a cost of increased risk of losses should producers release their stocks.

Table 5.4 shows the evolution of net returns to storage activities in three cities. The margins are computed with the assumption that traders store cereals for one month, i.e.,

cereals purchased one month are sold the following month. In addition, a 30% interest has been assumed by Mehta.

Table 5.4   Evolution of Net Returns to Storage (Millet, 1985-88)

	Koutiala	Bamako	Mopti
Years	Mean (CFAF/Kg)	Mean (CFAF/Kg)	Mean (CFAF/Kg)
1985/86	6 (7)[1]	6 (5)	0.1 (5)
1986/87	9 (3)	7 (3)	4 (5)
1987/88	17 (12)	18 (20)	12 (12)

1. Standard deviations in parentheses

Source: Extracted from Mehta (1989, p 133).

Although average net returns increased between 1985 and 1988, the standard deviations were unstable over the period with a sharp increase in 1987/88 for all cities. For example, the standard deviation was 7 CFAF/Kg in 1985/86, 3 CFAF/Kg in 1986/87, and 12 CFAF/Kg in 1987/88 for Koutiala. This instability of the standard deviation and its high level in 1987/88 for all three cities indicate that storage activities are high risk activities despite the increase in average net returns over the period. This high risk attached to storage activities may explain why traders did not respond to the credit programs by investing in cereals stocks despite the existence of positive returns.

5.2.2 Traders' storage practices

Marketing research in Mali since the market reforms indicate that traders prefer rapid turnover over stock holding. Mehta (1989) found that wholesalers from Bamako store

cereals for an average of eight (8) weeks, while semi-wholesalers store for an average of seven (7) weeks. Both wholesalers and semi-wholesalers from Mopti store cereals for an average of one week. Wholesale assemblers from the producing zone of Koutiala store cereals for one week only.

The preference of traders for rapid turnover over stock holding reflects not only the need to reduce the risk of storage activities that results from unexpected adverse price changes, but also the desire to reduce the cost of financing. For example, traders from Bamako who turn over their stock six times within a year can reduce an annual rate of 100% on an informal loan to 17%. Therefore, a rapid turnover of cereals stock constitutes an effective strategy to reduce the high interest rates charged on informal loans for traders with no access to formal credit markets. This may explain why traders have said that the interest charged on the diverse credit programs initiated by the government was too high since stocks acquired under these programs are turned over only once a year.

The differences in the length of stock holding between the three cities corresponds with the distribution of storage capacity among traders from these cities. Traders from Bamako have the highest storage capacity, followed by traders from the deficit zone of Tombouctou in the North. Surprisingly, traders from the producing of Koutiala have higher average storage capacity than traders from Mopti.

Table 5.5 Distribution of Mean Storage Capacities and Mean Stock Level in 1989

	BAMAKO	MOPTI	KOUTIALA	TOMBOUCTOU[1]
Storage capacity				
Owned	835	27	40	618
Rented	1645	56	98	99
Stock[2] level, Sept. 1, 1989	8,684	123	140	1,542

1.   Data are from Steffen (1992, pp 356)
2.   Data are from Steffen (1992, pp 356)

Source: CESA-MSU-USAID field surveys (1989; 1990)

The ratio of mean owned to mean rented storage capacity varies from 6:1 for Tombouctou, 0.5:1 for Bamako and Mopti, and to 0.4:1 for Koutiala. The data indicate that traders from the deficit North in Tombouctou rely less on rented storage capacity than traders from other cities. In contrast, traders from Koutiala tend to rely more on rented storage capacity than traders from urban centers. The ratio of mean owned to mean rented storage capacity increases as one moves from the producing zones of Koutiala and the urban centers of the South to the deficit North. This pattern seems to indicate that storage ownership in Tombouctou in the deficit North may be more profitable than elsewhere.

The distribution of the ratio of mean owned to mean rented storage capacity suggests that there may be differences in the storage cost structure between the South and the North. Indeed, the proportion of fixed cost (depreciation charges) in the total storage cost would tend to be higher in Tombouctou in the North than in urban centers of the South. Moreover, the total storage cost would tend to be variable rather than fixed in Koutiala than elsewhere because most of the storage capacity in that city is rented. This difference in cost structure between producing centers and urban consumption centers may

difference in cost structure between producing centers and urban consumption centers may be explained by a difference in the stability of the sources of cereals supplies.

Traders from producing zones rely on local sources of supplies, and shortfalls in local production cannot be compensated by getting supplies from other producing zones to achieve full capacity utilization of storage capacity. Therefore, one would expect the average owned storage capacity in producing zones to be lower the more variable is the local production. Moreover, one expects the average owned storage capacity to reflect the trend in cereals production, with traders renting storage capacity when production rises over its trend level.

In contrast to traders from producing zones, urban centers can rely on the national market for their coarse grain supplies and on the international market for rice imports. Therefore, urban wholesalers face more stable sources of supplies than wholesale assemblers. Therefore, the average owned storage capacity in urban centers will reflect the conditions of urban demand rather than local supply conditions. In addition, average owned storage capacity in urban centers will tend to grow with urban demand.

Data from table 5.5 indicate that urban wholesalers from Bamako had the highest level of cereals stock in September 1989, followed by traders from Tombouctou. The low level of cereals stocks for Koutiala and Mopti suggest that these two cities play the role of dispatching centers. Indeed, field investigations indicate that Koutiala ships cereals to Bamako and Mopti and that Mopti sells grain to northern cities such as Tombouctou and Gao.

The most interesting finding is the high level of cereals stocks in Tombouctou. This finding can be explained by the purchasing behavior of consumers in the North. For example, Steffen (1992) reports that market purchases accounted for 12% of total cereals

consumption for the higher income household during the 1989/90 harvest and post-harvest periods. This percentage rose to 47% during the hot dry season and to 31% during the rainy season. Thus, 78% of the effective cereals demand in the North became available after the harvest and post-harvest periods. However, Steffen's data cover a record production year for the Northeast. In normal years, there would be more market demand earlier in the season, although the general pattern of the seasonal distribution of cereals demand in the Northeast would still be as described above. As a result, northern traders have to store more cereals during the harvest period in order to meet consumers needs later in the year, especially given the transport problems of making regular shipments to Tombouctou in the dry season. However, findings by Mehta (1989) and Steffen (1992) also indicate that market concentration increases as one moves from the producing zones to the deficit zones of the North.

The findings by Mehta and Steffen suggest that cereals markets in the North are oligopolistic and that the fears of policy-makers about the ability of the private sector to supply these markets at competitive prices may be warranted. However, cereals marketing in the North is a risky business because storage in anticipation of consumers' demand later in the year plays a greater role in the North than in other cities well-served with road infrastructure. In addition, traders cannot predict when food aid will be distributed in the North. Thus, the high concentration ratios may result from both the requirement of a high scale of operations in order to cope with market uncertainties that result from unstable effective cereals demand and the overall small size of Northern markets.

5.3 Cereals export performance of traders

Expansion of cereals demand through exports during surplus years is believed by policy-makers to more cost effective than a stabilization program to support producer price

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during surplus production years. However, the expansion of Malian cereals exports depends on their competitive position in the West African regional market and the factors that affect traders' decisions to invest in grain export operations.

5.3.1 Cereals export opportunities

Mali is one of the Sahelian countries with the potential of becoming a major cereals exporter in West Africa (Badiane et al., 1992). This potential is reflected in the comparative advantage the country has in producing cereals, as measured by the domestic resource costs of cereals production. The domestic resource costs (DRC) of cereals production represent the ratio of the economic costs of the local factors of production engaged in cereals production to the value added measured in world prices.

Table 5.6 Domestic Resource Costs of Cereals in Mali and in other African Countries

Countries	Crops	Techniques of Production	Domestic Resource Costs	
			Farm Level	Wholesale/ Urban Level
Ivory Coast	Maize	Animal Power	0.42	1.04
		Manual Power	0.70	1.56
	Mil/Sorg	Animal Power	0.42	1.07
		Manual Power	0.58	1.32
Mali	Maize	Animal Power	0.43	0.79
		Manual Power	0.57	0.98
	Mil/Sorg	Animal Power	0.38	0.67
		Manual Power	0.51	0.84
Senegal	Maize	Intensive	0.35	0.66
		Semi-intensive	0.49	0.87
	Mil/Sorg	Intensive	0.57	0.86
		Semi-intensive	0.69	1.01
Guinea	Maize	Manual	0.59	1.62
		Manual Trad.	0.79	2.00

Sources: Barry, Salinger, and Stryker, as cited in Badiane et al., (1992).

The crucial DRC values for measuring international competitiveness is one (1). Crops with DRC values less than one indicate that Mali has comparative advantage in producing these crops.

The DRC values for millet/sorghum under both farm level and wholesale level in Bamako indicate that Mali has comparative advantage in producing these crops (see table 5.6). This comparative advantage is even greater when farmers use animal traction and experience yields increases. Thus, Mali not only has a comparative advantage in producing millet/sorghum, but the country can maintain a competitive position in cereals exports once it experiences productivity gains (Badiane et al., 1992).

The data from table 5.6 show that Mali can produce grain competitively (relative to imports) for its own consumption at the wholesale level. Although the data do not show how competitive Malian grain would be in various export markets (Senegal, Côte d'Ivoire, Mauritania), Barry (1994) reports that Malian sorghum and millet are competitive in Northern and Central Côte d'Ivoire. However, Mali has yet to translate this potential export market into export opportunities.

According to Badiane et al., indicators of production instability during the period of 1961 to 1986 show a value of 14% for Mali and 15% for other West African countries. The indicators are trend-corrected coefficients of variation and indicate the fluctuation of production over time around its trend value. The higher the coefficients, the more unstable the production. Moreover, the coefficients of correlation of production fluctuations show values of 0.59 between Mali and Côte d'Ivoire, 0.53 between Mali and Senegal, 0.54 between Mali and Niger, and 0.90 between Mali and Mauritania (Badiane et al., 1992).

The coefficients of correlation show that cereals production in Mali and in neighboring countries tend to move in the same direction. At the same time, cereals

production seems to be slightly stable in Mali than in neighboring countries. These findings suggest that Mali has a limited potential in expanding cereals exports with its neighbors. However, the country has yet to turn this limited potential into cereals export opportunities within the region.

According to Deme (1992), the net margins including returns to management and risk for a wholesale assembler from Koutiala, who exported millet to Abidjan in Côte d'Ivoire in January 1992, were 66 CFAF/Kg. The same wholesale assembler would have earned 36 CFAF/kg had he sold respectively in Korogho in Côte d'Ivoire and 11 CFAF in Bamako. These margins indicate that returns to millet exports to Côte d'Ivoire were higher than the returns to selling millet in Bamako for wholesale assemblers from Koutiala in January 1992. However, the returns include all the illegal charges traders have pay in shipping grain to other countries.

For wholesale assemblers from Kita in the region of Kayes, the net margins were 124 CFAF for exports to Nouakchott in Mauritania, 17 CFAF/Kg for exports to Dakar in Senegal, 40 CFAF/Kg for exports to Siguiri in Guinea. The same wholesale assemblers would have earned 18 CFAF/Kg had they sold in Bamako and 29 CFAF/Kg had they sold in Kayes. The data indicate that returns to cereals exports to Senegal were lower than the returns in the domestic market in January 1992. Although the findings by Deme indicate that returns to export operations may be positive, they cover only one year and do not take into account scale effects. Thus, the adequacy of returns to cereals exports cannot be inferred from these findings.

5.3.2 Performance of grain exporters

Regional trade in cereals with neighboring countries has always existed in Mali. The trade is supported by a dense network of informal channels, and most of the transactions

are not recorded (Egg and Igué, 1989; Gabre-Madhin and Diarra, 1990). As a result, the informal border trade has been qualified by policy-makers as unreliable and unable to deal effectively with large surplus production. Indeed, Egg (1989) has argued that most of the informal cereal trade within West Africa is determined by food policy and macroeconomic policy differences between countries.

In contrast to the informal border trade, the large scale trade demands that traders get export licenses and record their transactions. However, the big traders are also inclined to informality when cereals exports are determined by policy differences (Egg, 1989). Because of lack of data on the informal border trade, the assessment of the performance of grain exporters will be limited to the large-scale trade.

Table 5.7   Evolution of Official Cereals Exports

Years	Surplus[1]	Exports	Exports as % of Total Surplus
1986-87	306,100	7,443	2.4%
1987-88	127,636	190	0.2%
1988-89	469,706	9,425	2%
1989-90	560,153	35,000	6.3%
1991-92	-	11,278	-
1992-93	-	10,501	-

1. Surplus is defined as excess production over estimated domestic consumption requirements.

Source: Nafissatou Guindo, 1993

The performance of cereals exporters with respect to the volume of transactions has been disappointing during the period of 1986 to 1993 with regard to total available surplus

(defined as excess of production over estimated domestic consumption requirements). Total cereals exports have represented less than 10% of the estimated surplus of cereals production during the entire period. The exports have concerned mainly millet, sorghum, and maize. The main export markets during the period have been the Côte d'Ivoire, Senegal, and Mauritania. However, Malians who reside in France and in other African countries have started to provide export opportunities for grain exporters. For example, Malians from France imported 30 tons of cereals in 1987-88 while those in the republic of Congo imported 32 tons (Guindo, 1993).

The poor performance of grain exporters has been explained by the inability of grain exporters to make timely delivery of the contracted quantities with foreign clients and to meet quality specifications (Camara, 1990). For example, Camara reports that a grain exporter took five months to honor a delivery contract of 2,000 tons of cereals to Senegal in 1990. Such delivery delays make Malian cereals exports unreliable and prevent potential exporters from establishing stable relationships with potential foreign clients. In addition, the inability of traders to meet quality standards of export markets has also limited the expansion of cereals exports.

Although the recent devaluation of the CFA franc, a common West African monetary unit, should make Malian cereals exports more competitive if they were competing against exports outside the CFAF zone, the country must become a reliable supplier before it can take advantage of its export opportunities. This calls for identifying and relieving the constraints to timely delivery of grain to foreign clients and to meeting grain quality standards of export markets. Thus, there is a need to identify the factors that affect the decisions of traders to become grain exporters.

5.4 Determinants of traders' investment in storage and cereals exports.

The diverse credit programs that were set up in 1986/87 to encourage private stock holding were based on the assumption that access to cheap credit was the main determinant of traders' investment in cereals stock. Similarly, transportation subsidies were supposed to be sufficient to encourage traders to export. However, traders have not responded to these policy induced incentives. Therefore, other factors beyond returns to storage and export activities may be at work in the Malian context.

5.4.1 Hypotheses

Investment in stock holding was found to be highly risky despite the increases in net returns to storage between 1985 and 1988. Therefore, the ability to bear and to manage risk may be one of the major determinants of traders' storage behavior. The ability to bear risk is mainly a function of the scale of operations. Indeed, ability to bear risk means the maintenance of resources in reserve large enough to carry traders through any period of adversity.

The main risk management tools available to cereals traders are business diversification and contracting out. Diversification into other lines of activities allows traders to reduce the risk of stock holding if the revenues from the other lines of activities are uncorrelated with returns to storage. However, diversification is also a function of the scale of operations. Contracting out is merely a method of shifting or sharing risk with other traders. For example, a wholesale assembler who buys his supplies only when needed is shifting the risk of storage to rural collectors.

Traders who adopt implicit or explicit contracts can expect stable and regular supplies and demand of cereals. With stable and regular supplies there is no need to hold inventories beyond the level of normal working stock in anticipation of supplies shortfalls.

Similarly, contracts convey information about future levels of demand and thereby better enable traders to plan their level of working stock (Carlton, 1979).

Although ability to bear and to manage risk constitutes an important determinant of traders' storage behavior, availability of storage facilities and access to credit affect the returns to storage. Therefore, these two factors also affect traders' investment in cereals stocks. The rental cost of storage facilities constitutes a disincentive for storage activities. A high rental cost reflects a shortage of storage facilities available for renting.

The opportunity cost of resources invested in storage constitutes a major cost element of storage activity. This opportunity cost is usually measured by the prevailing interest rates. Thus, the higher the interest rate, the lower the level of investment in storage activities. This implies that access to formal credit, which charges a lower interest rate than informal credit, constitutes an incentive for storage activities. In contrast, ownership of trucks reduces the need for a trader to hold cereals stocks. Indeed, the possession of trucks gives more flexibility to traders and allows them to respond quickly to changes in demand conditions. For example, a trader who possesses a truck can immediately send it out in producing zones to get supplies when he faces a surge in demand.

Tomek and Robinson (1990) argue that increases in expected demand raise the level of inventories. They argue that increases in expected production relative to current and past production levels are the main shifters of demand for storage. However, increases in production without simultaneous increases in expected future demand will result in depressed prices, as the stocks are released later from storage into a limited market. Indeed, in Mali, during the first year of the credit programs, many traders were unable to sell their stocks in the domestic market to pay back their loans, as prices did not raise enough to cover storage costs. This experience led many traders to withdraw from the

program, as some of them suffered heavy losses (Steffen and Dembélé, 1989). Thus, cereals export opportunities that increase future demand may play an important role in traders' decisions to invest in storage. Therefore, returns to cereals exports become one of the main determinants of traders' investment in storage in anticipation of shipment abroad.

Only large-scale traders can collect information on the export markets and to spread the cost of collection over large transactions. Indeed, it was shown in chapter IV that the information structure in the cereals subsector fails to provide relevant information on external markets. Therefore, the scale of operation constitutes a determinant of cereals exports in addition to positive returns to export operations. However, an exporter must have access to cheap storage facilities to accumulate stock prior to shipment overseas. Moreover, an exporter must develop strong relationships with suppliers from producing zones in order to be able to accumulate on short notice important stocks of cereals.

The practice of credit needs planning or business planning constitutes an important determinant of export operations. At the same time, a minimum level of literacy may be required before a trader can deal effectively in international markets where most contracts are written and enforced by court systems. According to Thurow (198), adequate management and distribution systems enabled Holland to export cut flowers to America even though America could produce these flowers. For example, timely delivery of goods and services in export markets requires adequate planning of credit needs, logistics, and supplies.

Based on the above discussion, the following hypotheses are formulated:

(a) Cereals exporters stock more than non-exporters

(b) Investment in storage is a function of scale of operations.

(c) Adoption of contractual arrangements by traders for both supplies and sales in the

domestic market is a substitute for stock holding.

(d) Average stock level is a function of rented storage capacity.

(e) Average stock level is a function of access to formal credit.

(f) Ownership of trucks is negatively correlated with stock holding.

(g) Average cereals export level is a function of owned and rented storage capacity.

(h) Adoption of contractual arrangements with suppliers is positively correlated with the decision to become an exporter.

(i) Managerial ability as proxied by the number of years of credit needs planning practices and the number of years of formal schooling affect positively the probability of a trader becoming an exporter.

5.4.2. Relationships between explanatory variables

The different variables hypothesized to determine traders' investment in cereals stock and exports appear to be correlated. Indeed, the scale of operations and experience in cash flow planning may determine traders' access to formal credit. Similarly the level of rented storage capacity may be correlated with the scale of operations. Moreover, it was shown in chapter III that traders from the periphery have higher scale of operations, more managerial ability, and more access to formal credit than traders from the core.

The city of residence of traders may affect their propensity to export. For example, it is easier for urban wholesalers based in Bamako to arrange export operations because the communication facilities are better in Bamako than elsewhere in the country. Indeed, all of the traders from the periphery are based in Bamako and most of them are exporters. Thus, the city of residence of a trader is an important factor that influences his ability to export.

Table 5.8 presents the estimated correlation coefficients among the different variables.

Table 5.8 Correlation Coefficients Between the Determinants of Stock Holding and Exports

Correlations	STOCK	EXPO	SCAL	CAM	ACC	CRC
STOCK	1					
EXPO	0.80 (.001)	1				
SCAL	0.81 (.001)	0.92 (.00)	1			
CAM	0.77 (.003)	0.95 (.00)	0.94 (.00)	1		
ACC	0.25 (.23)	0.25 (.23)	0.28 (.20)	0.20 (.28)	1	
CRC	-0.24 (.24)	-0.16 (.32)	-0.17 (.31)	-0.15 (.33)	0.22 (.26)	1

Numbers in parentheses indicate 2-tailed significance level with N=11.

Source: Computed form field survey data, MSU-CESA-USAID,1990

The data used to estimate the correlation matrix come from the sample of 55 traders described fully in chapter IV. The variables are described as follow:

1. The level of average stock (STOCK) represents the average annual cereals stock in 1989 reported by the trader;

2. The level of average export (EXPO) measures the declared average annual exports in 1989;

3. Scale of operations is measured by the average monthly sales of 1989 (SCAL);

4. The level of rented storage capacity (CAM) is measured by the total rented storage capacity in 1989;

5. Access to formal credit (ACC) is a dummy variable that takes the value of one when a trader has access to the banks and other institutional credit sources and zero otherwise;

6. CRC is a dummy variable that takes the value of one when a trader sells more than half through contractual arrangements with clients and the value of zero otherwise.

The correlation coefficients between STOCK and SCAL is 0.81, positive as predicted, and highly significant. The correlation coefficient is 0.77, positive as predicted, and highly significant between STOCK and CAM. In contrast, the coefficients between STOCK and ACC is positive as predicted, but not significant and less than 0.5. Similarly the coefficient between STOCK and CRC is negative as predicted, but not significant and less than 0.5. However, one would not normally expect highly significant correlations with zero-one dummy variables. There is not as much variation as with continuous variables.

The highly significant and positive correlation coefficient between SCAL and STOCK indicates that traders from the periphery are more likely than traders from the core to invest in stocks. Furthermore, the strong positive correlation between rented storage capacity and scale of operation also indicates that the periphery is more likely to have higher rented capacity than the core. But, it was found in chapter IV that traders from the periphery made most of their investment in warehouses, while traders from the core invested mainly in trucking capacity. Hence, one would expect the core to rent more storage capacity than the periphery. However, investment in warehouses did start to fall after 1987. This corresponds to the year when OPAM stopped its stabilization program and made its idle storage capacity available for renting to traders along with other state owned enterprises such as Office du Niger. The fact that most of the warehouses made available by the former

state owned- enterprises are large in capacity implies that only large- scale traders can afford to rent them. This can explain the high correlation between scale of operation and rented storage capacity.

The weak correlation between stock holding and access to formal credit implies that availability of formal credit plays a minor role in the decision of trader to hold stock. This may explain the failure of the diverse credit programs initiated by the government to encourage private storage. Thus, the ability of the government to induce traders to hold important stocks at harvest to support producer price through cheap credit seems to be limited. Moreover, the negative correlation between contractual arrangements with domestic clients and stock holding indicates that contractual arrangements are substitutes for stock holding. The fact that traders from the core, who coordinate production and domestic consumption, tend to be small in scale indicates that contractual arrangements as coordination mechanisms are substituted for stock holding in the domestic market.

The interesting finding is the high correlation between stock holding and cereals exports. It is 0.78, positive and highly significant. This suggests that investment in stock holding and cereals exports move in the same direction. But, one cannot determine whether investment in stock holding causes a trader to engage in cereals exports or involvement in international markets causes a trader to hold stock in anticipation of foreign demand. However, field investigations do indicate that traders tend to contract first with foreign clients and accumulate stock afterwards.

The strategy of cereals exporters to sell first and to accumulate stock afterwards implies that involvement of a trader in international markets causes him to invest in storage. This is a risk management strategy that shifts the risk price changes to traders who supply exporters with grain. However, the strategy has its drawbacks. For example, many traders

may be unable to make timely delivery because it takes time to accumulate large quantities of grain on short notice without prior accumulation of stocks. Therefore, prices tend to rise to a higher level by the time an exporter has accumulated the contracted quantity and as many exporters enter the market. This rise in prices that results from the risk management strategy of cereals exporters makes Malian cereals exports very expensive and may cause many traders to miss their international contractual obligations.

If cereals exporters could start to accumulate stock at harvest in anticipation of foreign demand, there would be no upward pressure on prices when contracts are secured. This could make Malian grain more competitive in the West African regional market. However, traders would only do so if foreign demand could be predicted. Unfortunately, West African demand for Malian grain cannot be predicted because food imports (including food aid) and export policies are unstable in West Africa. Even if such demand could be predicted, traders who accumulate stock in anticipation of foreign demand would suffer losses should the Malian government ban exports, as happened during the harvest of 1989, before exports were authorized later in the year.

The correlation coefficients between cereals exports and the scale of operation is positive, as predicted, and highly significant. The coefficient for rented storage capacity is also positive as predicted and highly significant. Both coefficients are higher than those found between these two variables and the level of stocks. The correlation coefficient between cereals exports and access to formal credit is also positive, but insignificant and of the same magnitude as the coefficient between stock levels and access to formal credit.

The strong correlation between scale of operation and cereals exports suggests that traders from the periphery are more likely than traders from the core to invest in export operations. This finding further supports the result of chapter III of the existence of two

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substructures in the cereals market, with one substructure coordinating production and domestic consumption, and the other substructure connecting the domestic market to the international market. Moreover, the strong correlation between stock holding and cereals exports along with the strategy of traders to secure foreign contracts before investing in stock suggests that private storage within the periphery is determined primarily by the level of realized foreign demand. This implies that the efforts of the government to expand cereals exports through subsidies will have positive impact on private storage if these efforts are successful.

Although traders from the deficit North were not included in the analysis, Steffen (1992) showed that traders from Tombouctou, which is isolated and located in the North, also tend to hold large stocks in order to meet realized effective demand later in the year. Traders from Koutiala and Mopti were found to hold far less stock than traders from Bamako and Tombouctou (Steffen, 1992). Thus, the main sources of the demand for stock holding appear to be realized foreign demand and anticipated domestic demand in the deficit zones of the North. However, both sources are unstable. Indeed, foreign demand is subject to unpredictable policy changes, while unpredictable food aid distribution and highly variable local grain production in the deficit zones of the North makes effective demand unstable.

5.4.3. Estimated regression model

The strong positive correlation found between the scale of operations proxied by average sales in 1989 and rented storage capacity (CAM) indicates that the effect of these individual factors on average stock and average export cannot be easily determined through estimation of regression equations. Moreover, the high correlation between average exports, scale of operation, and rented storage capacity indicates that the presence of these three

variables in the stock equation would result in a strong multicollinearity. As a result, large variances would be associated with the estimated coefficients. Therefore, only the variable CAM will be used in the export and stock equation because this variable also affects the cost of storage. Moreover, EDUC was found to be correlated with ACR. Thus, only EDUC appears in the export equation.

(a) The model

The hypothesis that cereals exporters store more on average than traders who sell in the domestic market can be formulated as follow:

(5.1)   Average stocks (STOCK) = $\beta'x + \delta D + \epsilon$, where β and δ are parameters, x is a set of exogenous variables, D is a dummy variable that takes the value of one when a trader is an exporter and the value of zero when a trader deals only in the domestic market, and ϵ is an error term. However, δ may not measure the effect of being an exporter on average stock levels if the typical trader who chooses to become an exporter would have relatively high average stock whether or not he was an exporter (Greene, 1990). Therefore, the model is subject to selectivity bias, and least squares estimates of the stock equation will overestimate the effect of being an exporter. Moreover, the estimated coefficients will be inconsistent.

To correct for selectivity bias, the decision to become an exporter can be modelled as follows:

(5.2) $D^* = \alpha'z + u$

D = 1 if $D^* > 0$ and D = 0 if $D^* < 0$, where D^* measures unobserved returns to cereals exports, α are coefficients, z are exogenous variables that affect the returns to cereals exports, and D is defined as before. Thus, the stock equation can be rewritten as:

(5.3) $E(STOCK|D=1) = \beta'x + \delta + E(\epsilon|D=1) + v_1$

$= \beta'x + \delta + \rho\sigma_\epsilon\phi(\alpha'z)/\Phi(\alpha'z) + v_1$

(5.4) $E(STOCK|D=0) = \beta'x + \rho\sigma_\epsilon\phi(\alpha'z)/[1-\Phi(\alpha'z) + v_2$,

where the term $\rho\sigma_\epsilon$ measures the influence of the decision to become an exporter on average stock levels, and ϕ and Φ are density and cumulative functions respectively evaluated at $\alpha'z$ (see Greene, 1990, 747-748). Once equation (5.2) is estimated by probit model, the terms $\phi(\alpha'z)/\Phi(\alpha'z)$ and $\phi(\alpha'z)/[1-\Phi(\alpha'z)]$ known as inverse Mill ratios, can be constructed and used as explanatory variables in equations (5.3) and (5.4) respectively. Then, equations (5.3) for exporters and equation (5.4) for traders who sell in the domestic market can be estimated separately by ordinary least squares.

Maddala (1983) argues that equation (5.3) and equation (5.4) can be combined into a single equation and proposes the following reformulation:

(5.5) $STOCK = \beta_1'x + \epsilon_1$ if $D^* = \alpha'z + u > 0$ (D=1)

$STOCK = \beta_2'x + \epsilon_2$ if $D^* = \alpha'z + u < 0$ (D=0). From this reformulation, the following empirical equation is derived:

(5.6) $STOCK = \beta_2'x+(\beta_1-\beta_2)'x\Phi(\alpha'z)+(\sigma_{2u}-\sigma_{1u})\phi(\alpha'z)$. Note that equation (5.6) is equivalent to $\beta_2'x[1-\Phi(\alpha'z)]+\beta_1'x\Phi(\alpha'z)$, where $1-\Phi(\alpha'z)$ measures the probability of D=0 (not being an exporter) and $\Phi(\alpha'z)$ measures the probability of D=1 (being an exporter). Clearly, the explanatory variables x have been scaled down by the respective probabilities of not being an exporter and being an exporter.

Equation (5.6) corrects for selection bias and can be estimated by ordinary least squares (Maddala,1990). If self-selection into the group of exporters is based on comparative advantage and exporters store more than traders who sell in the domestic market, then the term $(\sigma_{2u}-\sigma_{1u})$ must be positive (Maddala, 1983). Thus, the interest is on

the sign and the level of significance of the term (σ_{2u}-σ_{1u}).

To estimate the empirical model, variables listed in table 5.5 were used along with the following variables defined as follows:

1. Managerial ability (ACR) is measured by the number of years of credit needs planning practices;

2. EDUC is the number of years of formal schooling.

Other variables to be used later are defined as follow:

3. TRUC measures the trucking capacity owned by a trader in tons;

4. CAMAP measures the storage capacity owned by a trader in tons;

5. EPO is a dummy variable that takes the value of one when a trader is an exporter and the value of zero otherwise, and

6. BAM, MOPT, and FRC are defined as before.

(b) Results and analysis

Table 5.9 presents the results of the estimated empirical model. Variables indexed by one are those variables multiplied by $\Phi(\alpha'z)$ (the probability of being an exporter) for each trader, and their coefficients measure their differential impact on average stock levels for exporters and non-exporters (β_1-β_2).

The most important finding in the stock equation is that the coefficient for $\phi(\alpha'z)$ which measures (σ_{2u}-σ_{1u}) is positive and significant at the 10% level. This result supports the hypothesis that exporters store more on average than traders who sell in the domestic market. Furthermore, the result suggests that correcting for selectivity bias was necessary to get consistent estimates of the model and that traders who select themselves into the group of exporters have comparative advantage in cereals exports over the average trader.

The finding that self-selected exporters are better than the average trader in cereals

export operations suggests that if the aim is to expand exports as quickly as possible, then the government should focus on these self-selected exporters. By targeting these self-selected exporters to promote cereals exports, the government will promote at the same time investment in storage. Thus, the diverse credit programs designed to promote traders' investment in storage should be directed to the promotion of cereals exports as increased exports would lead to increased storage.

The coefficients for rented storage capacity and owned storage capacity are positive, as predicted in the export probit equation. Only the coefficient for owned storage capacity, which is an indicator of the scale of operations of a trader, is significant at the 5% level. The coefficient for education and adoption of contractual arrangements with suppliers are positive as predicted, but not significant. Thus, the possession of adequate storage facilities appears to influence strongly the decision of a trader to become an exporter.

Once a trader has decided to become an exporter, the availability of rented storage capacity has a positive and greater impact on his average investment in storage than on the average investment in storage for a non-exporter. Indeed, the availability of rented storage capacity affects negatively the average investment in storage for traders who sell in the domestic market. The negative relationship between the availability of rented storage capacity and investment in storage for non-exporters may reflect the locational effect of Bamako. Indeed, there is more rented storage capacity available in Bamako, most of the exporters are there, and on average exporters store more than non-exporters. Thus, one would expect a statistically negative relationship between rented storage and investment in storage by non-exporters.

Similarly, access to formal credit has no effect on traders' investment in storage for both exporters and non-exporters. Thus, the storage credit program will not induce traders to

invest in storage to support producers price during surplus production years.

The coefficients for FRC, CRC, and TRUC are negative for traders who sell in the domestic market, as predicted. Although the coefficients are not significant, their negative sign does suggest that contractual arrangements and ownership of trucks are substitutes for investment in storage for traders who sell in the domestic market (see appendix III). In contrast, contractual arrangements with suppliers and ownership of trucks affect positively average investment in storage for exporters. However, the differential impact of FRC and TRUC on average investment in storage for exporters and non-exporters is not statistically different from zero.

The results of the regression model has profound implications for the government efforts to promote traders' investment in storage and cereals exports. The results suggest that the core which is made of small-scale traders who deal mainly in the domestic market, would not invest in stock holding for the domestic market as long as they can rely on contractual arrangements. Moreover, the core has no comparative advantage in cereals export operations.

Table 5.9   Estimated Equations for Exports and Stock

Variable	Probit Equation (Dependent = EPO)	Stock Equation
CAMAP	0.1715**	
	(2.295)	
CAM	0.9617	-0.5870*
	(1.567)	(-2.225)
EDUC	0.5628	
	(0.619)	
FRC	0.1467	-25.086
	(0.313)	(-0.271)
CRC		-58.377
		(-0.527)
ACC		190.83
		(1.342)
TRUC		-3.5666
		(-1.011)
ACC1		33.558
		(0.072)
CAM1		0.7515*
		(2.827)
FRC1		125.38
		(0.439)
CRC1		-422.54
		(-0.911)
TRUC1		1.2151
		(0.112)
$\phi(\alpha'z)$		1046.2**
		(1.902)
Constant	-1.5145	-100.45
	(-3.725)	(-0.817)
Chi-Squared	19.168	
Adjusted R^2		0.65
N		
	55	55

Single asterisk means significant at the 5% level and double asterisk means significant at the 10% level.

The findings of the regression model suggest that large-scale traders who own storage capacity are more likely to become exporters. These exporters were found to store more on average than traders who sell in the domestic market. Moreover the availability of rented storage capacity was found to have a positive impact on average stock for exporters. Therefore, the availability of low cost storage facilities for cereals exporters through cereals exports promotion programs would have positive impact on traders' investment in storage. However, the targeting of government assistance to cereals exporters may result in a strong concentration of the cereals trade. This raises a policy dilemma. Indeed, the positive correlation found between scale of operation, cereals exports, and stock holding indicates that some degree of concentration of the cereals trade may be a precondition for the promotion of cereals exports and increased stock holding during surplus production years. But, such concentration may lead to monopolistic pricing behavior in the domestic market if few exporters dominate the cereals trade. However, the atomistic competition that characterizes the domestic market is made of many small-scale traders who substitute ownership of trucks and informal contractual arrangements for stock holding. As a result, farmers would have to continue to bear most of the risk attached to stocks holding in the absence of a large-scale private sector.

Chapter VI

6. Summary and Policy Implications

The main objective of this dissertation was to analyze the determinants of traders' investment in storage and cereals exports. The focus has been on the determinants of traders' choice of alternative coordination mechanisms as they relate to investment in marketing infrastructure, cereals stocks, and cereals exports. The research asked the fundamental policy question of whether traders have the ability and the resources to invest in marketing operations and infrastructure in such a way that provides adequate incentives to farmers to invest in cereals production for expanded commercial use, given farmers existing technology. The research extended the transaction-cost approach to address this fundamental question.

The research first used cluster analysis to determine whether the structure of the private marketing system comprises two different substructures. Second, means comparison tests were carried out to determine whether the two substructures that compose this marketing system had the same average total net investment in marketing infrastructure, and whether the choice of alternative coordination mechanisms had an impact on the level of average investment in marketing facilities, storage, and cereals exports. Third, a discrete choice model was estimated to examine the impact of years of experience, managerial ability, degree of specialization in cereals trade, scale of operation, degree of diversification, and the spatial distribution of cereals transactions on the likelihood of a trader adopting relational contracting. Fourth, simple correlation coefficients and regression equations were estimated to examine the relationship between stock holding and scale of operations

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(proxied by rented storage capacity), access to formal credit, ownership of trucks, rented storage capacity, managerial ability, and choice of contractual arrangements on the one hand, and the relationship between cereals exports and scale of operations proxied by rented and owned storage capacity, adoption of contractual arrangements with suppliers, and years of formal schooling on the other hand.

The data used in the different analyses were collected in 1990 under the Malian component of the Food Security research project in Africa carried out by Michigan State University an financed by USAID. These data were updated in 1993 with a grant from the Rockefeller Foundation. This chapter presents the main conclusions and the policy implications of the study. The first section reviews the findings of the research and its limitations. The second section presents the policy implications of the study.

6.1. Summary of Findings

The market reforms of 1981 were based on the implicit assumption that the removal of legal constraints to private cereals marketing would improve marketing efficiency through increased competition. Moreover, policy-makers believed that the market reforms would induce traders to invest in marketing infrastructure and operations. Although past marketing research in Mali has shown that traders were able to allocate efficiently already produced grain, policy-makers lacked empirical information on the willingness and the ability of traders to invest in market expansion activities to dispose of surplus production at prices that offer positive returns to farmers.

When OPAM stopped its market stabilization program in 1987, the government set up diverse credit programs and offered export subsidies to encourage both private storage and cereals exports to try to support the producer price at harvest. These credit programs failed to induce traders to hold cereals stocks, and the export subsidies were not successful

in inducing increased cereals exports during surplus years. As a result, the return of surplus

production after 1987 has led to permanently depressed producer prices at harvest. Thus,

the downward pressure on producer price that translated into negative returns to farm labor

has become the main policy concern for the Malian government and the PRMC since 1987.

The fundamental problem that must be addressed is the lack of adequate investments in

market demand-expansion activities of stock holding, export operations, and cereals

transformation for both human and non-human uses. This study has addressed this

problem.

6.1.1. Structure of the marketing system

Although researchers have distinguished traders by size, past marketing research in

Mali has recommended the same policy intervention for all classes of traders. This study

has shown that the private marketing structure comprises two substructures, referred to as

the core and the periphery.

The core and the periphery differ by their scale of operations, the managerial ability

of their members, their access to formal credit markets and to the court system, and by the

type of markets they serve. The core comprises small-scale traders who lack adequate

managerial skills. Traders from the core lack access to formal credit and to the court system

to enforce contracts. The core deals in the domestic market. It assures the spatial and

temporal allocation of grain in the domestic market. Thus, the core is responsible for the

coordination of production and domestic consumption. The periphery connects the

domestic market to the international markets. It is responsible for most of the large scale

cereals exports and imports. The periphery comprises large-scale and skilled traders who

have access to formal credit market and to the court system to enforce contracts.

The structure of marketed surplus requires labor-intensive marketing techniques at

the rural assembly and urban retailing level. Low-skilled and small-scale traders from the core are ready to supply the necessary labor at low returns because of lack of alternative employment. In contrast, traders from the periphery have alternative uses for their skills and their capital. Thus, the supply of skills and capital within the periphery may be very responsible to changes in marketing margins.

6.1.2. Investment in Marketing Facilities

Real net investment in storage and trucking capacity has increased dramatically since the market reforms of 1981. Although annual growth rate was higher during the pre-reforms period than during the post-reforms period, annual average real net investment in both storage and trucking capacity was found to be higher after the market reforms than before the reforms. Thus, traders have responded to the market reforms by increasing investment in marketing facilities according to the assumption of policy-makers.

Traders from the periphery and traders who use relational contracting were responsible for most the investment in storage capacity before the reforms. In contrast, traders from the core and traders who rely on the spot market made most of the investment in trucking capacity. Although traders from the periphery and traders who use relational contracting had a higher share of total net investment before the reforms, this situation was reversed after the reforms. In 1989, traders from the core and traders who use spot market transactions as coordination mechanisms had the highest share of total real net investment.

Real net investment grew faster for traders from the periphery and traders who use relational contracting as coordination mechanisms than for traders from the core and traders who use spot market transactions before the market reforms. After the reforms, investment grew faster for the core and traders who use spot market transactions than for the periphery and traders with relational contracting. Thus, investment within the core and

for traders who use spot market transactions was more constrained before than for the periphery and traders with relational contracting.

Belonging to the periphery and the use of relational contracting led to higher annual average real net investment before and after the market reforms than belonging to the core and use of spot market transactions. Moreover, investment was more stable for the periphery and traders with relational contracting than for the core and traders who rely on spot market transactions. The effect of being from the periphery and using relational contracting was to stabilize the stream of investment. The fact that investment grew faster for the core with no access to formal credit than for the periphery after the market reforms indicates that policy reforms are far more important than access to formal credit to induce increased private investment in marketing facilities.

Storage and trucking capacity also grew dramatically after the market reforms. The increase was more important for storage capacity than for trucking capacity. This indicates that the marketing system is moving away form borrowed physical capital towards owned capital. Employment also increased after the market reforms. It appears that the employment lost within OPAM during the process of the market reforms was gained back in the private sector, although a precise estimate was not available. The most important gain after the market reforms was the replacement of the high- skilled workers of OPAM by the unskilled traders from the periphery.

The use of contractual arrangements as a coordination mechanism between wholesale assembling and urban wholesaling was found to be associated with higher annual net investment and more stable investment than the use of spot market transactions. Thus, increased use of contractual arrangements that improve vertical coordination is likely to result in higher and more stable investment in the marketing system.

6.1.3 Determinants of Traders' Choice of Coordination Mechanisms

The results of the discrete choice model showed that both the attributes of cereals transactions and the socio-economic characteristics of traders were important determinants of traders' choice of contractual arrangements over spot-market transactions. The traditional approach of transaction-cost theory that relates only the attributes of transactions to the choice of organizational forms tends to reflect only the demand side of organizational forms. However, the results of this study indicate that the supply factors as they affect the ability of transactors to choose alternative coordination mechanisms are as important as demand factors in predicting the choice of organizational forms in the context of developing countries.

Experience, scale of operations, and the practice of cash flow planning (credit needs planning) as indicators of socio-characteristics increased the probability of a trader adopting contractual arrangements over spot-market transactions. Being a wholesale assembler rather than an urban wholesaler, as a measure of spatial distribution and an attribute of cereals transactions, was positively associated with the likelihood of adopting contractual arrangements. The degree of specialization in cereals trade, a proxy for the degree of asset-specificity and an attribute of cereal transactions, was positively associated with the likelihood of a trader adopting contractual arrangements.

Increases in the number of years of cash flow or credit needs planning practices as a measure of managerial ability increases the likelihood of traders adopting contractual arrangements. Similarly, increases in the scale of operation raises the likelihood of a trader adopting contractual arrangements for supplies acquisition, but decreases the probability of a trader engaging in contractual relationship with his clients. The main finding was that as the scale of operation increases, traders were more likely to avoid informal contractual

arrangements and to rely on spot-market transactions, as they can manage risk through diversification. Indeed, the small-scale trade was found to use informal contractual arrangements to manage marketing risk, while the large-scale trade uses diversification as a risk management tool.

6.1.4 Determinants of Traders' Investment in Storage and Cereals Exports

Average net returns to storage increased between 1985 and 1988. Similarly, the risk attached to storage activities has also increased. Deme (1992) found that returns to cereals exports to Côte d'Ivoire were higher than returns to cereals trade in the domestic market in 1992. Despite the increase in returns to storage and to cereals exports, traders have not yet responded fully to these incentives according to the expectations of policy-makers. Traders from the deficit North store more than urban wholesalers from Bamako and Mopti. Wholesale assemblers store less grain on average than urban wholesalers. With respect to cereals exports, traders have exported less than 5% of marketed surplus production in any given year.

The scale of operations and the availability of storage capacity were found to be positively correlated with average stock holding. Indeed, the high risk attached to storage activities implies that only traders of a sufficient scale are able to bear such high risk. Thus, the ability to bear risk as reflected in the scale of operations of a trader determines to a large extent his storage behavior. Indeed exporters were found to store more on average than traders who sell in the domestic market. Therefore, the periphery, which is made of exporters was more likely than the core to invest in stock holding.

Traders from the core substituted ownership of trucks and contractual arrangements on both sides of the transaction for stock holding. Indeed, adoption of contractual arrangements for supplies and sales was found to be substitute for stock holding for traders

who deal only in the domestic market. In contrast, adoption of contractual arrangements with suppliers was found to influence positively the level of average stock holding for cereals exporters. Thus, the choice of alternative coordination mechanisms led to different storage behavior depending on whether or not a trader is an exporter. Average cereals exports were found to be positively related to stock holding, scale of operations, and to availability of storage capacity. The tendency of traders to secure contracts with foreign clients before accumulating stock implies that average stock levels within the periphery were determined by realized foreign demand. Moreover, expected effective demand in the deficit North determines also the average level of stock holding.

Access to formal credit was found to be less important in determining traders' investment in stock holding. However, the fact that the scale of operations was found to be strongly and positively correlated with both stock holding and cereals exports, indicates that credit constraints tend to vanish with increases in scale of operations. Indeed, high scale of operations increases the ability to bear risk and to spread the high cost of collecting information on international markets, thereby giving lenders more confidence that a trader will be able to pay back a loan.

The regression results for the exports equation showed that owned storage capacity, which is an indicator of the scale of operations, was the main determinant of cereals exports. This finding is consistent with the assumption that a trader needs to achieve a certain scale before engaging in large-scale export operations in order to spread the cost of collecting information in export markets. Moreover, high scale of operation allowed traders to better handle the risk associated with cereals exports and stock holding. Small-scale traders who cannot bear such risk substituted contractual arrangements for stock holding.

6.1.4 Limitations of the Study

This study used a sample of 55 traders in three cities. Although these traders are representative of the population of traders in their respective cities, the sample does not fully reflect the differences in road infrastructure and stability of marketed surplus across the whole country. For example, traders from the deficit North and from the regions of Kayes and Koulikoro with unstable marketed surplus were not included in the estimation of the discrete choice model, means comparison tests, the computation of the correlation coefficients, the regression equations. This limits one's ability to generalize the results of the study to the whole country.

This study was not able to assess fully the impact of instability of marketed surplus and the quality of road infrastructure in different producing zones on traders' choice of alternative coordination mechanisms. Although cross tabulations showed that wholesale assemblers from Koutiala with good roads and a more stable marketed surplus contracted more with rural assemblers than wholesale assemblers from Koulikoro and Kayes with poor roads and unstable marketed surplus, further study is needed to assess the impact of the quality of road and the instability of marketed surplus on traders' ability to adopt different coordination mechanisms.

6.2. Policy Implications

With the limitations in mind, many policy implications can be drawn from the study's findings. First, the structure of the marketing system was found to be a dual marketing system, with high scale and skilled traders with access to formal credit market and to the court system for contract enforcement on the one hand, and small-scale, low-skilled traders with no access to formal credit and the court system for contract enforcement on the other hand. This implies that any policy intervention must make the distinction between these two

groups in their ability to respond to policy measures. Second, belonging to the periphery and the use of contractual arrangements to coordinate wholesale assembly and urban wholesaling were found to be related to high annual average net investment in marketing facilities and more stable investment streams. As a result, any policy intervention that increases the use of contractual arrangements is likely to result in higher and more stable investment in the marketing system. Specifically, teaching traders from the core to make the distinction between their own financial needs and those of their businesses and to adopt forward planning of the cash flow needs of their businesses through appropriate training programs is likely to stabilize the stream of investment within the core.

Third, access to credit was found to play a minor role in the expansion of investment in marketing facilities and in stock holding and cereals exports. This implies that any credit program for grain wholesalers is likely to displace existing credit sources of traders without any important impact on private stock holding and cereals exports. As a result, the ability of policy-makers to shift the storage function from producers to traders through cheap credit to support prices at harvest is limited. Thus, the termination of the diverse credit programs is supported by the findings of this study. Fourth, stock holding is determined mainly by traders' ability to bear risk, realized foreign demand, and expected demand from deficit zones.

Traders from the core substituted contractual arrangements and ownership of trucks for stock holding in the domestic market. In contrast, exporters from the periphery hold most of the stock. Thus, the efforts of the government to expand cereals exports through providing better information on export market opportunities are likely to increase stock holding at the same time. However, the expansion of cereals exports calls for the government to target large-scale traders in the short run and to make available adequate

information on foreign demand to all traders to increase the number of exporters in the long run.

The fundamental policy question to be addressed is how to move traders from the core to the periphery to increase storage through the promotion of cereals exports and to stabilize the overall investment in the marketing system. The main finding of this study indicates that cash flow planning, which indicates that a trader has made the distinction between his own cash needs and those of his business, was the most important limiting factor in the shift from the core to the periphery. In addition, the high cost of collecting information on international market appears to limit entry in the export business for many traders.

The findings of the study suggest that atomistic competition, made up of many small-scale traders, is unable to bear the risk attached to storage and cereals exports. Therefore, a reform that only leads to small-scale trade cannot promote traders' investment in storage and cereals exports to expand market demand and provide incentives to farmers to invest in cereals production if it does not address the issues of risk bearing and economies of scale in information gathering. The key analytic issue to address is how progressiveness is related to scale. With economies of scale present in information gathering, the institutional design issue is what alternative ways exist to capture those economies? Does the government focus on large private firms, large public firms (e.g, OPAM for information gathering and diffusion), or trader cooperatives? In the short-run, the best answer to the institutional design question may be to focus on the periphery to capture the important scale economies to gaining progressiveness. In the long-run, public firms must provide adequate information on export opportunities to increase the number of cereals exporters.

The main policy recommendations that flow from this study are that targeting large-scale traders for export promotion programs, the availability and free access to adequate information on foreign sources of demand, availability of adequate and low cost storage facilities, and appropriate training programs directed to the core are likely to have higher pay offs than any credit programs in promoting traders' investment in storage. Training to confer the appropriate skills in business planning to traders from the core is important to move them to the periphery. Most important, traders from the core must be trained to make the distinction between the gross sales revenue and net revenue. Moreover, these traders must learn to separate the accounts of their businesses from their personal accounts, and to avoid using the sales revenue of their businesses for their personnel expenses in order to initiate a process of capital accumulation.

APPENDICES

APPENDIX I

ACCESS TO FORMAL CREDIT AND PERIOD OF ENTRY IN GRAIN TRADE AMONG TRADERS BY ADOPTION OF TYPES OF COORDINATION MECHANISMS

Table A.1.   Access to Formal Credit

	Relational Contracting[1]		Spot Markets	
Access to formal credit	N	%	N	%
YES	12	57%	9	43%
NO	20	59%	14	41%

1.   Relational contracting refers to cases where a wholesale assembler from producing zones makes more than half of his sales through regular contracting. For an urban wholesalers, relational contracting refers to cases where an urban wholesaler acquires more than half of his total supplies through regular contracting.

Table A.2.   Period of Entry In Grain Trade

	Relational Contracting		Spot Markets	
Period of entry	N	%	N	%
Before PRMC	23	62%	14	38%
After PRMC	9	50%	9	50%

Table A.3.   Adoption of Types of Coordination Mechanisms by Substructures

Substructures	Relational Contracting		Spot Markets	
	N	%	N	%
Periphery	7	54%	6	46%
Core	25	60%	17	40%

APPENDIX II

DISTRIBUTION OF REAL NET INVESTMENT IN STORAGE AND TRUCKING CAPACITY BY SUBSTRUCTURES AND BY ADOPTION OF TYPES OF COORDINATION MECHANISMS

Table B.1. Real Net Investment in Storage Capacity (Million CFAF)

Years	Periphery	Core	Spot Markets	Relational Contracting
1972	6	0	0	6
1973	6	0	0	6
1974	9	0	0	9
1975	7	0	0	7
1976	6	0	0	6
1977	5	0	0	5
1978	8	9	9	8
1979	7	8	8	7
1980	89	7	7	89
1981	77	6	6	77
1982	72	11	6	77
1983	77	10	5	81
1984	117	8	4	121
1985	125	56	67	114
1986	136	80	93	122
1987	132	72	89	115
1989	122	73	88	106
1989	116	69	84	101

Note: Total real net investment is the sum of real net investment of the periphery and the core or the sum of real net investment of traders who use relational contracting and of traders who use spot markets. Numbers do not always add up because of rounding up.

Table B.2. Real Net Investment in Trucking Capacity (Million CFAF)

Years	Periphery	Core	Spot Markets	Relational Contracting
1972	0	0	0	0
1973	0	0	0	0
1974	0	0	0	0
1975	0	0	0	0
1976	0	0	0	0
1977	0	0	0	0
1978	0	11	11	0
1979	0	9	9	0
1980	0	8	8	0
1981	0	6	6	0
1982	0	5	5	0
1983	20	4	4	20
1984	16	29	26	19
1985	14	63	60	17
1986	55	63	57	61
1987	53	52	47	58
1989	44	53	38	59
1989	38	142	126	54

Note: Total real net investment is the sum of real net investment of the periphery and the core or the sum of real net investment of traders who use relational contracting and of traders who use spot markets. Numbers do not always add up because of rounding up.

APPENDIX III

DISTRIBUTION OF SALES, STOCK, AND EXPORT BY ADOPTION OF TYPES OF COORDINATION MECHANISMS.

Table C.1.   **Mean Sales, Stock, and Export By Types of Coordination (Thousands tons)**

	Contractual arrangements[1]			Spot markets		
	Average	STD[2]	N[3]	Average	STD	N
Sales	67	73	2	210	544	32
Stock	20	21	13	600	847	10
Exports	3333	4041	3	2448	5176	13

1. Contractual arrangements refer here to acquisition of supplies and sales through regular contracting for more than half of total business.
2. STD stands for standard deviation.
3. N stands for the number of valid cases

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